INTERNATIONAL

Management Digest®

TECHNICAL • INDUSTRIAL • COMMERCIAL

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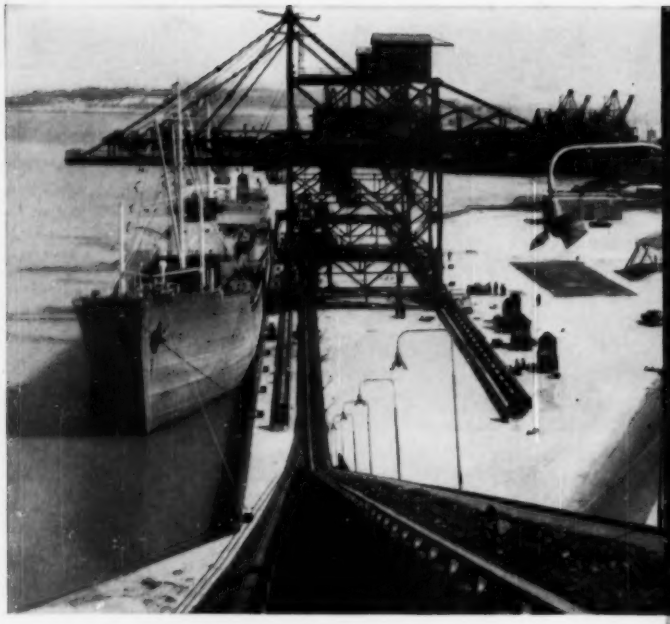

Dockside Robots

Baltimore and Ohio RR., one of the country's finest ore unloading docks at Baltimore, Maryland. Large ships can be emptied within 14 hours, their ore cargos delivered to rail cars by S-A belt conveyor. Two huge ship unloaders remove ore in 20 ton bites.

CONVEYOR SYSTEMS IN PORTS ALL OVER THE WORLD SAVE DOCKSIDE DOLLARS —KEEP PRODUCT TRAFFIC MOVING—AUTOMATICALLY.

From chemicals to bulk foods, loading or unloading, there are no "in port" tie-ups—no bottlenecks—when STEPHENS-ADAMSON engineered conveyor systems go into action. These facilities are supplying the "push" to bulk products in many busy ports all over the world.

S-A systems may range from a small portable conveyor to huge complex projects encompassing the construction and installation of multiple belt conveyors, marine gantries, storage and processing facilities, elevators, ship trimmers, feeders, transmission equipment, etc.

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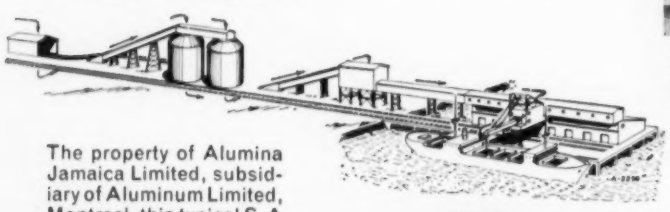
STEPHENS-ADAMSON products and engineering services are available to you thru engineer-sales representatives located throughout the world. More than fifty years of company experience is behind their advice and recommendations. Dockside or shipboard, they can help you cut your materials handling costs.

Port of Hilo, Hawaii utilizes S-A conveyor system to transport sugar from storage to shipboard. Moving to dockside via belt conveyors the sugar is loaded by movable gantries into ship's hold. Ship trimmer distributes cargo evenly from chute extending down into hold.

Ship loading facilities for this Malayan mining operation located north of Singapore were designed by S-A engineers. Here 200 to 300 ton barges are loaded and then floated to ships at off shore anchorages. Ore moves over belts at 500 tons per hour.



The property of Alumina Jamaica Limited, subsidiary of Aluminum Limited, Montreal, this typical S-A conveyor system is located at Port Esquivel, Jamaica. In ship loading operations here, alumina is handled at a rate up to 700 tons per hour.

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The FORTY FIVE

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Weight — 10,800 kg (23,800 lb.)
Speeds — 6 forward to 33.1 kmph (20.6 mph)
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Other features that appeal to highway and construction engineers include: the high-strength, single-member tubular frame; ROLL-AWAY moldboard that *rolls* the earth, instead of merely pushing it; fully enclosed power steering; unit construction for quick removal and servicing of components.

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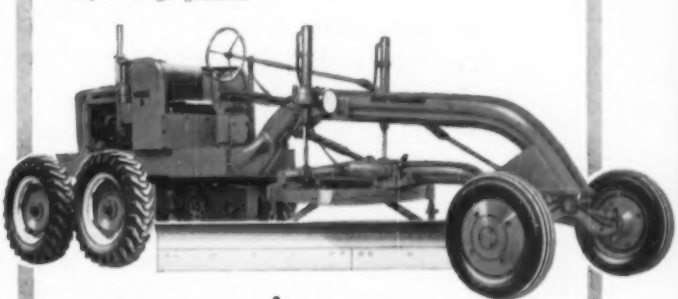

Allis-Chalmers 50-hp diesel engine (gasoline engine available).
Weight — 4241 kg (9,350 lb.)
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reverse 5.1 kmph (3.2 mph)

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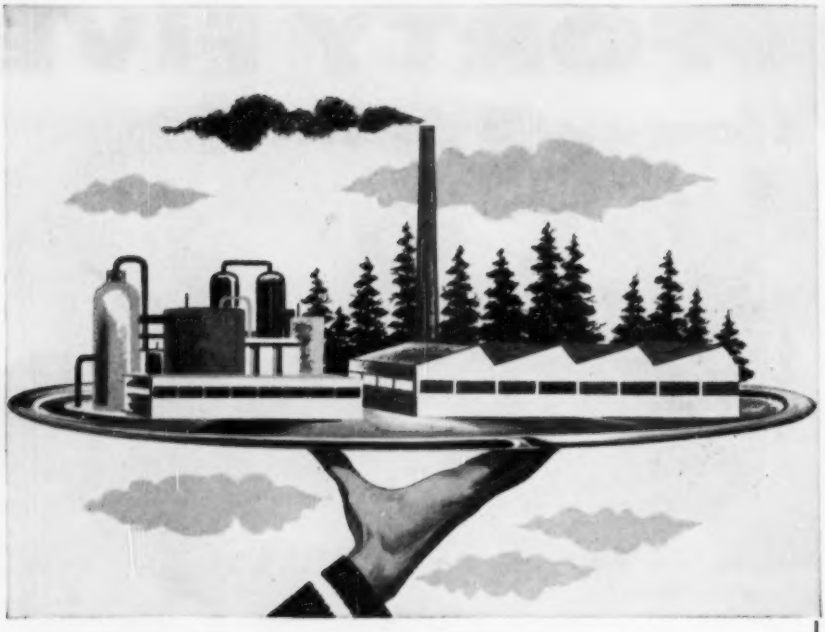

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THE BEST FROM 68 BUSINESS MAGAZINES

MARCH 1957
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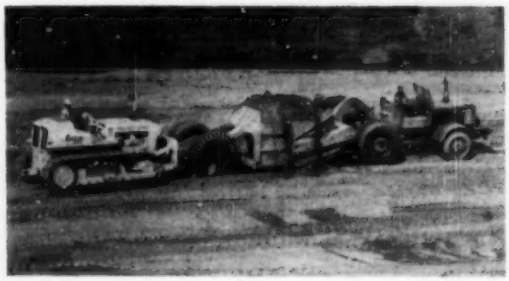

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MARCH 1957

The Readers Report . . .

From IFC to MD

Sir . . . Thanks for sending me Management Digest of January with the story of my Santiago speech. I am naturally very pleased and complimented with your treatment of it.

I also extend my best wishes for the growth of this publication. I see how it can perform a most useful function in spreading a conception of sound management and industrial development around the world.

R. L. GARNER, President
INTERNATIONAL FINANCE CORP.
WASHINGTON, D. C.

Permission Granted

Sir . . . Editions "PILOTE" are issuing the publications of both the Centre d'Etudes des Problemes Industriels and of the Ecole d'Administration des Affaires de Lille. . . . Our review "Chefs d'Enterprise" is sent to selected business managers, industrial associations, young managers' clubs, business schools in France and in French-speaking countries.

Would you be kind enough to give us permission to publish in "Chefs d'Enterprise" a translation of "New Hope for Unity in Europe" and "Business Flying has Come of Age", from Management Digest of December, 1956.

PAUL LEMAITRE, Director
EDITIONS PILOTE
LILLE, FRANCE

Sir . . . We are asking for your kind permission to translate and print for distribution among industrial concerns in Brazil the article "How to Use the Business Doctor," of the October, 1956, issue.

Our organization has been engaged for several years in engineering and management consulting. This is a job for pioneers, and our greatest efforts are directed to make the Brazilian businessman believe in organization and its methods.

Eng. SERGIO KEHL
ORGANIZACAO E ENGENHARIA
SAO PAULO, BRAZIL

● Management Digest receives requests from publications and organizations all over the world who wish to reprint our articles. We are delighted with them. The publisher does insist that any plan to reprint be cleared with us here in New York—and permission will almost always be granted by return air mail or cable.

More Inflation Worries

Sir . . . Brazil is the land of classic inflation, and also any type of equipment and price level is being offered here. I am really glad to have found in your article ["When You Buy—Figure on Inflation"] some directly applicable assistance in my yearly headache of what to buy and how to justify it.

WALTER CHRISTIAN
SAO PAULO, BRAZIL

Sir . . . I would certainly be happy to receive a copy of the full paper by Dr. Jelen ["When You Buy—Figure on Inflation"] which, I am sure, is of particular interest in the European countries ridden with inflation. Incidentally may I congratulate you on the very excellent magazine which you are putting out and which I read with great interest.

JEAN DHAVERNAS, President
OXY—FRANCE
PARIS, FRANCE

● Well over 100 copies of this report on equipment cost in an inflationary era have gone out to Management Digest subscribers. There are still some left.

A Briton Responds

Sir . . . We have recently subscribed to your paper, and it is certainly not our practice to enter into political discussions with business associates, but on reading your January edition I was shocked by the first paragraph under the heading "World Trends" . . .

A vast majority of those with whom I have discussed the issue [the British-French invasion of the Suez area] believe that our mistake was not in going in but in coming out, under what most people regard as U.S. rather than U.N. pressure. They believe that we should have gone on, as you would have gone on had it been Panama, as you, in fact, did go on in Korea, as you still go on in Formosa and as your President has now announced that you intend to go on in the Middle East if your interests are involved.

I write all this not as criticism, because we both have our own interests, as well as very considerable mutual interests, at heart, but I think it dangerous and a possible source of ill feeling when an American proclaims confidently what the Englishman thinks, as you have done. . . .

Finally may I say that I find your magazine of great interest when dealing with its own subject, even if I do not quite agree with your interpretation as to what I am thinking.

D. E. STOCKER,
Managing Director
SPRINGFIELD HOSIERY
FINISHING CO.
NOTTINGHAM, ENGLAND

Two of these 1980-hp General Electric universal diesel-electric locomotives (Model UD18B) are already in service on the Mexican National Railways. Eight identical units are on order.

Mexican National Railways expands its modernization program with 1980-hp diesel-electric locomotives from General Electric

The Ferrocarriles Nacionales de México is the largest rail system in Mexico, with a total track length of 9,748 miles. It connects with the U.S. in the north, and runs south to the Guatemalan border.

Recently two UD18B General Electric diesel-electric locomotives were tested by the railroad on its own tracks. During their 2-month trial period (each engine travelled more than 20,000 miles) the units proved so efficient that the Government kept the two demonstrators and placed an order for eight more locomotives of identical design, to be delivered immediately.

The units ordered are 1980-hp, 120-ton workhorses from G-E's new standard universal line. They have greater tractive effort and higher horsepower ratings than other locomotives of the same general type. They're extremely versatile and can be used for passenger, freight or switching purposes. They'll do *more work faster*... fewer units are needed... investment is kept to a minimum.

Find out how these new General Electric diesel-electric locomotives can benefit your railroad. For complete information, contact your nearest International General Electric Company representative. (135-E9)

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WORLD TRENDS

JAPAN AND ITS TRADE

What can the world business community expect from Japan?

Look at the new quota agreement on textile exports to the U.S.A. Many foreign traders were relieved that the quotas are voluntary on Japan's part, and not imposed by the American Congress. They feared that Congress might not stop with quotas on just Japanese goods.

The Japanese negotiators went home satisfied that the quotas were the best they could get. But they wonder if other countries will follow suit with restrictions—"voluntary" or otherwise—on Japan's goods.

Japan can still count on its American markets, to be sure. But the quota agreement will probably intensify Japan's efforts to diversify both its markets and its export products.

Last year's exports reached record levels—$2,500-million; the balance of payments showed a healthy surplus; Japan sold many more machines, precision and optical goods, toys in world markets. And, it became the world's leading shipbuilder.

Still, Japanese economists are worried. They fear that resistance to basic Japanese exports will grow in important markets. And they are concerned with clouds hanging over the domestic economy.

Japan has been riding the world boom; and industrial production is at a new high. Yet the present prosperity seems fragile.

The nation continues to struggle with too much population, too few raw material resources. Japanese industry becomes increasingly high-cost as prices and wages spiral upwards. Money, power, transport are all in short supply.

The new Ishibashi government is expected to present a deflationary budget, and tighten monetary controls. And while it says it will liberalize present restrictions on foreign capital investment, outsiders have their doubts. As for Japan's trade associations, you can expect them to exert even stronger control on the nation's foreign commerce.

CANADA LOOKS AHEAD

More wealthy, more influential, a greater trader, and perhaps even an exporter of capital. That is Canada in 1980.

Canadians, in the midst of their boom, have taken a long, hard look at themselves. An independent (and highly objective) Royal Commission has just reported that Canada, in 1980, will have:

—A population of 26.6-million (up from 16-million now), including a net immigration of 75,000 yearly.

—Gross national product up from nearly $30,000-million last year to $76,000-million. There will be ten times as much Canadian oil, 15 times as much gas, three or four times as much electricity—and a 67% increase in per capita income.

—Greatly increased trade, and possibly investments, in Europe, Asia, Latin America, as well as in the U.S.A.

Canada will have its growing pains; it will need more people, more capital, good business conditions. But the trend is strongly upward.

Turn the page for more WORLD TRENDS

Foreign investment in Canada—and especially U.S. investment—is the most interesting, and controversial, subject in the report.

Canadians agree that foreign capital has played a crucial role in their development—just as it did in the U.S.A. years ago. But the Commission emphasized a major Canadian worry: that Yankee capital has become too dominant in several important industries. Oil and gas, autos, electrical and rubber goods, mining, chemicals, are examples.

The Commission's recommendations include requiring foreign investors to sell more stock to Canadians, bring more Canadians into top management, channel more money into bonds and mortgages instead of stock. Tax incentives might be one way of bringing these changes.

To be sure, Canadians welcome foreign capital—and there is no talk of tough measures such as "nationalization." What the Commission recommends is, rather, more "Canadianization."

These recommendations are not apt to be adopted soon. But Canada's continuing debate on the role of the foreigner will be watched, not only by Canada's trading partners, but by governments and businessmen around the world.

TRENDS IN TECHNOLOGY

Metalworking: An exciting new method may form "non-formable" metals in the future. It uses explosive cartridges, and is called shock forming. For example: One experimenter punches holes in super-strength steels (up to 18,000 kilograms per square centimeter tensile strength) with a piston punch driven by a 22-caliber cartridge. Punch speed is 25 meters per second; holes are clean with squared edges and no radial cracks. Other possible applications: flaring and bulging of tubing.

The method is based on the release of energy at such high rates that the metal is shaped before it has a chance to crack. Most researchers think the phenomenon has something to do with the speed that shock waves can travel through a material. If the forming tool travels faster than sound, it precedes the shock wave that causes work hardening and breakage.

Nuclear Physics: Scientists probing the atom have proved an apparently "basic" law of nature false. For 30 years the "law of parity" has rigidly defined the behavior of sub-atomic particles.

Now, two Chinese-born physicists, with the help of the U.S.A.'s Columbia University and the Bureau of Standards, have shown that parity is not universal; it applies only in special cases. This is the significance of their discovery: Some observed phenomenon could not be reconciled with parity; thus the law has stood in the way of a better understanding of fundamental physics. One result may be a Unified Field Theory with which Albert Einstein struggled.

Petroleum: The world's largest—and most inaccessible—reservoir of crude oil may finally be tapped. Royalite Oil Co. Ltd. expects to spend $50-million in a four-year plan to recover the oil locked in Canada's famed Athabaska tar sands. Reserves are phenomenal—some 100,000-million to 300,000-million barrels. But no one has successfully extracted the oil on a commercial basis. Nor has anyone tried very hard.

As a starter, Royalite will build a 20,000-barrel-per-day processing plant. The key units will be centrifuges that spin the sand from the petroleum, something like a dairy cream separator. With luck, the project may be producing in volume by 1960.

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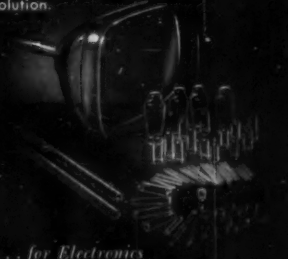

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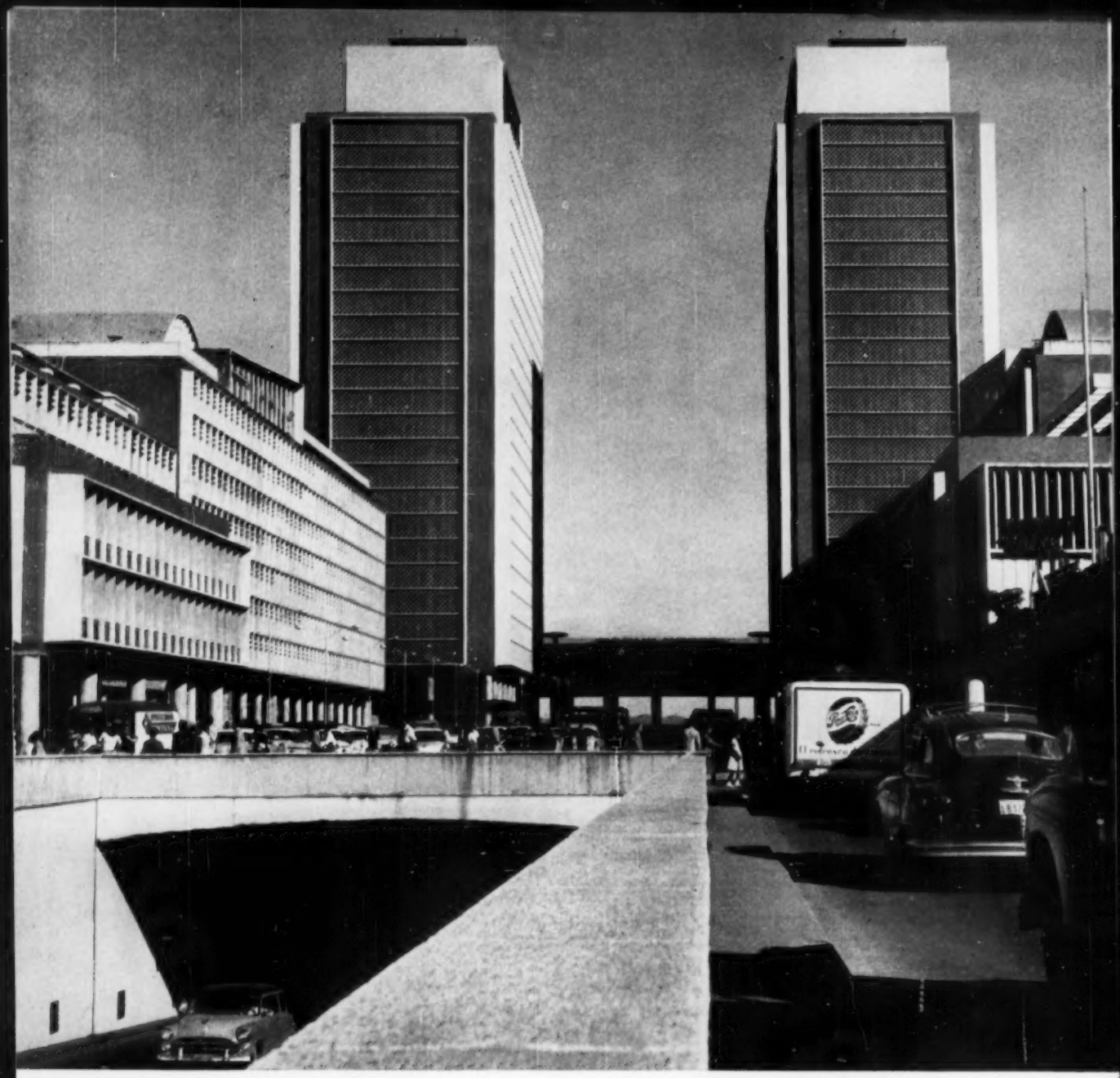

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In Latin America

Coming: A New Stability?

Is Latin America moving into a period of more stable, better balanced economic development?

There is no quick answer. Looked at as a whole, Latin America resembles nothing so much as a kaleidoscope: Twenty vastly different nations meeting different problems, with varying successes —and failures. It is a diverse, always-changing, portrait.

Yet there is a common denominator in Latin America. It is unsatisfied demand—for food, roads, schools, power, factories, and all the things that factories can produce. Each nation is trying to meet the demands of rising population by building a more productive, "industrialized" economy. And as this industrialization moves ahead, trends are appearing throughout Latin America.

Do these emerging trends promise more stability, more balance? A "No" answer comes almost as easily as "Yes." A pessimist can point to the continuing ravages of inflation, mounting deficits, energy shortages, and the always-heavy dependence on exports—which are in turn dependent on the whim of the business cycle in other parts of the world. If there were another serious depression, says the pessimist, Latin America would face chaos.

But this answer ignores the changes that have taken place in Latin America in the past decade.

The pace of Latin American industrial growth is little less than astounding. Total production of all goods and services (measured in constant 1950 prices) is two and one half times that of 1935, 62% ahead of 1945. In the past ten years, manufacturing output has increased 77%, compared to agriculture's 51%. The number of persons employed in manufacturing and building has grown twice as fast as the total labor force; output per industrial worker has jumped 23% to $1,159, compared to an agricultural output of $320. In the face of the world's fastest rate of population increase, Latin America has managed a real increase in per capita output.

The population of large cities is growing at twice the rate of rural population. At the same time, the expanding road network is opening undeveloped rural areas to a new role as suppliers and markets for the big cities.

The pace of progress differs, to be sure. A new chemical plant in Sao Paulo represents a different stage of development than the first road into Paraguay's hinterland. Yet the "multiplier" effect of new development is the same.

In either case, more people gain a larger stake in a functioning market economy. More workers require regular wages; more farmers require regular access to market. The process spreads. More businessmen acquire expensive capital plants, and foreign investors put more funds at risk. Each group in society begins to realize that its welfare depends on continuity in policy and planning —by government and by business managers. Slowly, each group demands more stability.

Inflation is the major enemy of fast-developing nations. Uncontrolled price rises soon begin to distort development, encouraging speculation, discouraging investment in productive facilities. One by one, groups of the population are hurt.

Today, there are signs that the attack on inflation is moving ahead with more resolve.

Governments are gaining experience in the use of monetary and credit controls; they are considering wiping out the kind of rigid restrictions that tend to perpetuate inflation, and are struggling to reduce budget deficits. Mexico has done an impressive job in restraining inflation; so has Peru. Early last year Chile finally launched an anti-inflation program. Bolivia is just beginning to battle what has probably been Latin America's worst inflation.

It is not so much a question of what course to follow—but how to follow it, and make the medicine politically palatable. Many economists believe that Brazil's inflation has finally begun to threaten the nation's growth. Yet many Brazilians still profit from the speculative price rise, and others are not yet frightened enough to unite for strong action. That takes time. The important thing is that each month more Brazilians find themselves squeezed and are insisting that inflation be curbed.

Unbalanced economic growth is both a cause and a symptom of inflation. In the rush to industrialize and become independent of imports, the industrial sector of an economy moves ahead while food output, natural resources development, roads, power, export production lags far behind. Argentina's troubles provide an example of what unbalanced, badly-managed development can do. Mexico's prosperity is testimony to a more balanced growth.

No nation can attain the ideal of perfectly balanced growth; none ever has. It is more a question of emphasis. Industry will continue to receive major attention in many nations. Yet most observers of Latin America report

TOQUEPALA **No other activity, say the economists, promises such rapid productivity gains as mineral development. Above, at huge Toquepala copper deposits in Peru, work begins on area's largest single mining project.**

a growing disposition among businessmen and governments to give other parts of their national economies greater emphasis.

You see agricultural problems getting more attention. The same is true of mineral development policies. Transport is receiving a much greater share of investment, and Latin America is embarked on one of the world's greatest roadbuilding ventures.

Much of this is basic development—such as transport. And as such, it must usually be financed by governments. At the same time, government involvement in purely industrial undertakings seems to be losing its appeal.

Despite a preference for public power development, private (and usually foreign) utility companies are planning expansion, and report a more favorable outlook for their operations. Some of the government development corporations, who frequently take the lead in setting up new industry, are looking for ways to return a new industry to partial or wholly-private operations. Even in the field of transport, the Cubans have a formula where private syndicates, with authority to sell bonds, build highways or tunnels.

The Cuban scheme focusses attention on one of the great problems of Latin American industrial development. There are few functioning private capital markets, no widespread ownership of industrial stocks. Very few Latin Americans have any experience with industrial stocks.

But Latin American financial experts have noted the beginnings of capital markets in several nations. Security trading on the Caracas Bolsa, for example, jumped 10% last year—with stock transactions accounting for 43% of the total, compared to 25% of the total the year before. Investment banking houses are active; here and there a company has raised money by selling securities.

A vital capital market takes many years to develop—but the sooner the better for Latin America. To keep up the growth rate of the past decade, new capital investment will have to go ahead fast—from about $8,300-million in 1955 to perhaps $12,000-million in 1960. Any mechanism that helps direct more capital to where it is needed most will help.

Latin America should be able to count on a steady, if not increasing, flow of private capital from abroad. The climate for private foreign investment has improved in many nations over the past five years—Peru is an example. In others, such as Brazil, trade restrictions have moved many former export suppliers to invest in production facilities.

U.S. investment in Latin America has at least doubled in book value since the war. A recent U.S. Department of Commerce survey, covering 85% of the American companies active in Latin America, shows they invested $600-million in 1955, with reports of a "much higher" level in 1956. This mounting tide of U.S. investment, plus the funds from Europe, has an impressive role in economic development.

How impressive it is was not clear until the Dept. of Commerce study. Overall, the U.S. companies studied produced goods and services in Latin America during 1955 with a market value of $5,-000-million. Of these, about $2,-200-million were exported. The companies used about $1,300-million in foreign exchange to pay for imported equipment and materials, and to remit profits.

Since export sales plus capital inflow totalled about $2,300-million in foreign exchange, the net direct exchange return to Latin America was $1,000-million. But the companies also produced $2,-500-million worth of goods for sale within Latin America, many of which would have had to be imported otherwise. Thus, foreign investment of these companies alone made a contribution of several billions of dollars toward easing Latin America's balance of payments problems.

Despite these favorable influences, Latin America is haunted by its overwhelming dependence on markets in other areas. Barely 10% of the 20 republics' total trade takes place among themselves. Transport problems, exchange difficulties, low income, small isolated markets—all these have kept intra-Latin American trade low.

Now Latin Americans have begun to give much closer attention to the possibilities of regional cooperation. There are at least two natural combinations: the five Central American republics; and Argentina-Brazil-Chile-Uruguay-Paraguay. Perhaps Grancolombia is another.

There may be important benefits for Latin America in arrangements such as the Europeans Payments Union, and in the kind of mutual self-help pioneered by the Organization for European Economic Cooperation.

Regional development in Latin America may take decades. Yet a start has been made—especially in Central America. Later this year, the United Nations Economic Commission for Latin America will take further steps toward drafting a payments union agreement, and there is already talk of "common markets" for certain products.

Meanwhile, each nation is pushing ahead on its own. A brief idea of how the 20 republics are doing is presented on the next page. ●

In Latin America

A Panorama of Opportunity

Argentina

Huge opportunities for expanded farm output, exports, and industry in a highly-developed, but badly mismanaged, economy. Recovery from Peronism moving slowly. But continued good weather and fair prices promise rising income in 1957. Urgent needs: power, transport, machinery replacement—with foreign capital to pay for it. Greatest danger: political instability, and more inflation.

Bolivia

A nation in trouble as tin mining declines (with further deterioration likely) and Latin America's lustiest inflation. Government now seems determined to seek stabilization—and is receiving U. S. help. Brightest hopes: oil development, hydro power, new roads opening new farm lands.

Brazil

"Colossus of the South" keeps growing: industrial output rising 6% yearly, a parade of foreign investors come to make their fortunes (and protect their markets) in fast-diversifying economy. Government struggles to solve power, transport, food problems, staggering under mounting budget deficits and watching prices rise over 20% yearly. The world asks: How long before inflation and speculation endangers growth? And what happens if coffee prices fall?

Central America

Mostly good business and steady progress. . . . **Guatemala** enjoys steady coffee earnings, highway building, new oil and timber investments. Needed: more diversification. . . . **Costa Rica** has found a little oil, a little bauxite; while banana earnings have dropped, coffee is up. New roads open nation. . . . **El Salvador** is doing nicely—mainly with coffee—but small industries are developing. . . . **Nicaragua** has construction, road and port development, cotton, coffee, and cattle. . . . **Honduras** lags, but tries to attract foreign capital, build roads, open small industry against background of political uncertainty. . . . Central America needs economic cooperation, and—eventually—a common market of its 9-million people.

Chile

Can Chile control the inflation that has plagued her for 10 years —an average annual price rise of 24%? Battle was joined early in 1956—with some progress, some recent setbacks when Chileans rebelled against "austerity." Chile attempts to diversify industry and agriculture, with important production gains last year. While copper mining industry is healthy, lower prices may reduce earnings this year.

Colombia

Potentially rich and diversified economy continues to develop industry, transport, power, agriculture. Foreign investors and local business optimistic for long term —provided present financial difficulties are solved. Colombia simply bought too much on strength of high coffee prices—now faces "austerity." Outlook: good, provided debts are put in order.

Cuba

The island is booming—thanks to high sugar prices and new local and foreign private investment amounting to over $400-million in three years. Oil, nickel, cobalt output is rising; tire, paper, refining, aluminum fabrication plants are in operation or planned. And there is important new public works and power development. For all that diversity, Cuba must still further reduce dependence on sugar.

Dominican Republic

Brisk business at home—especially in public works and other construction, more tourism, and rising agricultural exports keep the nation prosperous. The outlook is for more of same, provided sugar prices remain favorable.

Ecuador

Industrial development has come late to Ecuador—but it is surely coming. Textile plants are being modernized; small cement, edible oils, ceramics, drugs, paper plants are appearing; fertile new lands are opening up. Foreign investors are welcomed — and Europeans seem especially interested. Problem: marketing difficulties and disease threaten banana exports—which earn three-fifths of the nation's foreign exchange.

Haiti

Hurricanes, flood, drought, unrestrained spending, and finally politics have plagued Haiti. Coffee sales—especially to Europe—are off, but tourism continues to grow as nation's second largest export. Haitians hope their big irrigation-agricultural development project will be ready by 1959; meanwhile they look for aid from the outside.

Mexico

Few nations have enjoyed such well-diversified development as Mexico; few can boast a more favorable outlook. National output continues to climb—in iron and steel, power, oil, farm products (especially cotton and coffee). Private industry—including foreign manufacturing investment—thrives behind tariff walls; the bulk of imports are investment goods and industrial materials. Mexico's secret? Good luck, and good financial management that has restrained inflation and encouraged enterprise.

Panama

Panamanians are excited about a planned refining, petrochemical, and port development at Colon—

biggest project for Panama since the canal. Oil and mineral exploration is proceeding; tourist income is up; new roads are underway; Panama City construction booms.

Paraguay

Resources are limited, and there's a small (1.5-million) unskilled population, poor transport, great dependence on Argentina as trading partner. Yet nation is starting to stir. The government has revised the foreign exchange system, offers concessions to foreign investors and to essential imports, and is building roads. Paraguay has growth potential in cattle-raising and forest products.

Peru

Diversified development, a high level of capital investment, good fortune and good financial management benefit Peru. Exports of both agricultural and mineral products are climbing; so is home industrial output (chemicals, fertilizers, a steel mill, cement, electric power). Foreign investors thrive in a stable, free economy. Major new project is the huge southern Peru copper venture. Problem: a tendency to inflation.

Uruguay

A stable, pastoral nation, depending heavily on sales of wool, meat, wheat; if present drought threat eases, outlook is favorable—especially for wool. Peso has had inflationary flush; commerce is complicated by multiple exchange rates. Uruguayans hope to encourage manufacturing industry. But home market is small, resources limited.

Venezuela

New records are shattered almost every day in this oil-soaked El Dorado. Petroleum production approaching incredible rate of 3-million barrels daily; government public works (some $500-million yearly) keep construction active; iron ore exports are rising and important new mineral reserves are turning up. Lots of money being made in manufacturing community. But credit is scarce, competition fierce.

In Latin America
Management Men

Latin America's rapid industrial growth makes great demands on management skills. Slowly, these demands are being met.

You see it in the rising emphasis on efficiency, cost accounting, supervisory and executive training, management consultants. Executives send young men to business school, and they themselves are joining management groups.

Below, MANAGEMENT DIGEST introduces five Latin American businessmen. They are not supposed to be "typical," nor are they necessarily the best known or most able Latin American executives. But their experiences serve to prove that good management is, after all, the first essential of industrial development.

Luiz Dumont Villares typifies the Sao Paulo management man—and civic leader. His latest scheme is to revolutionize the fast-growing city's transport. Villares has invented an automatic garage; soon Paulistas will ride to work on electric buses from Troleibus Villares. Some day, they may crowd aboard Villares-built subway cars.

Two brothers active in the far-flung Villares enterprises credit Luiz with "limitless energy and keen imagination." The family, of Portuguese-French stock, came to Brazil over 150 years ago. About 40 years ago, an older brother started a small elevator repair shop. Out of that came Elevadores Atlas—and a licensing agreement with an American firm to manufacture elevators. The company grew along with Sao Paulo's multi-story skyline. Under another license deal Villares enterprises started to manufacture electric motors, and then alloy steels and heavy hoist equipment. Later license deals put Villares into piston rings, metal castings for the textile industry, and finally trolleybuses. The licensors include German, British, Austrian, and North American companies.

Now in his early 50s, Luiz Villares is a mixture of Brazilian pioneering, European training, U.S. management thinking. His success rests on his ability to blend all three. Villares' own formula goes something like this:

"Build up business in essential products at home. Develop a good, faithful clientele. Then go abroad for the best in production know-how, and, finally, make the product yourself—right at home.

Romulo O'Farrill de Silva is a self-made Mexican. And he believes in roads. A moving force behind the Pan American Highway, a founder of the Mexican Road Assn., a strong advocate of rural roadbuilding, O'Farrill will be decorated in May by Cuba for his work in promoting the Circuito del Golfo. That's the plan for a road through the Yucatan jungle to connect with Cuba by ferry.

Roads are not O'Farrill's business—but they are essential to his business. After quitting school to become a mechanic, he made a fortune assembling and selling

At Work

autos and trucks. His fortune grows as road mileage increases.

His management technique is above all imaginative—turning ideas into action. Besides his autos, trucks, and roads, O'Farrill owns the influential Mexican City newspaper Novedades, and is the founder of Latin America's first television station.

Carlos J. Echavarria, manager of Coltejer (Cia. Colombiana de Tejidos), Medellin, is the son of the founder. But he thinks like a professional manager responsible to stockholders—which he is.

The big textile firm is especially proud of its 18,000 stockholders; over 14,000 of them hold lots of 500 shares or less. And the stockholders are pleased with Coltejer. For one thing, they no longer have to present their stock to receive dividends—thanks to Coltejer's new punchcard dividend system.

An electronic accounting system is the latest innovation in Echavarria's 17-year tenure as manager. "A company as big as ours needs automation," says Echavarria. "The electronic brain is necessary if you want to organize well and if you want to know what is going on in the company." But he adds that better management is not limited to "automation," but includes employing better machinery, time-and-motion studies, job evaluation.

Industrial and public relations are a special forte of Echavarria. Sports have been his hobby since school days in the U.S.A.

The Coltejer football team is the Colombia amateur champion, and Coltejer employees hold national championships in cycling and tennis.

Echavarria recently returned to Colombia after sharing management ideas at the Third International Conference of Manufacturers in New York. And he is enthusiastic—not only about Coltejer's potential, but that of Colombia as a whole. "Business prospects for 1957," reports Echavarria, "are very good."

Alberto Espinosa Jr., 30 years of age, has five years of experience as manager of Productos EFE, Caracas, Venezuela—perhaps Latin America's largest ice-cream manufacturer. And he is currently working on the company's fourth expansion in as many years.

Espinosa's policies aim at creating a mass market for a product hardly known a few years ago. The company now distributes 18 products, including 30 flavors of ice cream—in the Federal District and five states. The expansion plan calls for a cross-country network of distribution centers, with plants in key areas later.

Espinosa took over his parent's small firm in 1951, after going to school in the U.S.A. and working with an American dairy products company. In five years, Productos EFE production has tripled, and the company's shares have climbed 70% since stocks were registered on the Caracas Bolsa last October. Last year, EFE churned out 3-million liters of ice cream. And Espinosa talks of a 35% sales increase for 1957.

Espinosa is no rarity in Venezuela, where a youthful management generation is introducing new methods and new attitudes wholesale. EFE plant capacity is double current production, but Espinosa keeps equipment running at top speed until each day's quota is met. Production bonuses on hourly-rated capacity of machines help set the tempo for future output. Espinosa stresses good employee relations—and last year he supervised an annual profit sharing of 20%.

Ovidio Gimenez — manager of Argentina's Molinos Rio de la Plata—led his country's delegation to the First Pan American Management Conference, held in Chile last November. "It was an important event," he says, "especially for Argentine businessmen who for a long time have been isolated from such international contacts." And he adds that such interchanges of management information are of utmost importance to Latin America.

Gimenez did not come into his present position through family connections; he got his first job with Molinos in 1935 through a newspaper advertisement. It took him 15 years to work up to the manager's post. He is also an officer and director of milling companies in Uruguay and Paraguay.

His own success has made Gimenez a persuasive advocate of professional management. His "hobby," he says, is developing new executives—creating a managerial group in Argentina. Argentina used to be a country of "small artisans and family business," Gimenez explains, but industrial development has reached a point "where we must have an executive class, trained in the most modern methods." ●

In Latin America

Steel: Vital to Growth?

How do you evaluate Latin America's surging steel expansion? Has steel production been uneconomic, too hasty? Or has it made a vital contribution to industrial development?

In the latest edition of *Latin American Business Highlights*, economists of the Chase Manhattan Bank suggest some of the answers, and point to the future of Latin American steel.

There is no more dramatic reflection of Latin America's growth than the figures for steel consumption and production. In the past decade, steel use has risen to 6.6-million tons—an average annual increase of 10%, twice the growth rate for production of all goods and services. In the next decade, steel consumption will at the least double, and may rise to 17-million tons.

Imports have, of course, met most of the demand. In 1955, the 20 republics spent about $700-million, 9% of their total import bill, on steel. This covered three-fifths of consumption.

But almost to a man, Latin Americans want to reduce their dependence on imports. A steel mill, they believe, is more than a symbol of advancing industry, or even a foreign exchange saving. It is an utter necessity if a nation is to move toward that stage of development where metalworking occupies the center of the industrial stage.

Thus the rise in steelmaking capacity is even more dramatic than the rise in consumption. Since 1939, eight integrated steel mills have been built, four in Brazil, one each in Colombia and Chile, two in Mexico. Capacity has soared from 600,000 tons to 3.36-million tons, representing a total investment that the Chase experts estimate at $1,500-million.

Programs underway or recently announced would increase capacity to 6.4-million tons in 1960, at a cost of perhaps another $1,500-million. Brazil, with almost half the present capacity, plans major expansions; Argentina, still the largest steel consumer in Latin America, has started its own integrated mill. Peru's first plant is almost finished; Venezuela has just begun construction.

If these projects are carried through, over three-fifths of Latin America's steel may be produced locally in 1960.

Steel mills pose difficult problems—so difficult that some economists fear that Latin America may be going too far too fast in building capacity. For example:

—very heavy capital investment is required, $3 for every $1 of product each year. Integrated steel plants are a big drain on capital resources, and mean large external debts as well.

—very few nations have large enough markets, for the many thousands of different steel products, to support the most efficient size steel mill. Few have adequate fuel and raw material resources.

—steel prices generally are set at, or close to, the cost of imported steel, including tariff. So far there seems to be little advantage in Latin American steel output from the viewpoint of consumers' costs, and perhaps a disadvantage to national economies in the drain on scarce capital.

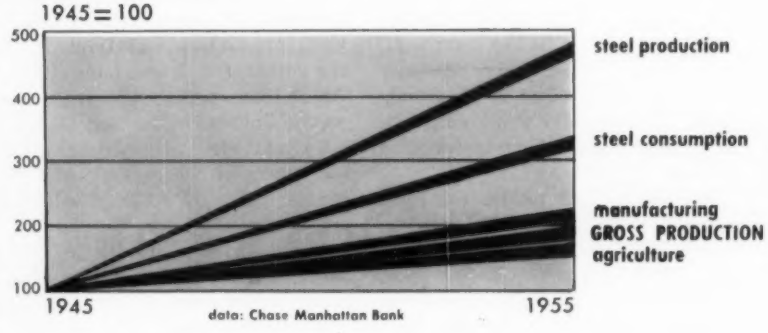
A persuasive answer to these objections, notes the Chase Manhattan Bank study, is in terms of the importance of expanding steel supply to a developing economy. In theory, imports can fill the bill. In practice, many nations cannot supply enough foreign exchange for all their steel needs. And they worry that shortages, or trade disruptions, will limit their supply.

In the end, steel availability—at home—may well be a key factor in overall economic growth. A steel industry often spurs wider industrial development by spreading technical knowledge, and stimulating local metalworking enterprises. Indeed, the Chase economists believe that, while accurate figures are not available, the steel production surge has probably accelerated economic development—largely by stimulating the growth of metalworking.

This has happened even though, over the short run at least, steel prices have not been substantially reduced by local production. Over the longer-term, *Latin American Business Highlights* suggests that further industrial growth may make possible the economies of larger-scale production. (That will be especially true if intra-Latin American trade increases.)

It is also possible that Latin American growth may raise the demand for steel at an even faster rate than the planned rise in local production. That will mean an expanding market both for locally-made steel and for imports of specialized steels that no one local mill can produce economically. ●

SURGING STEEL



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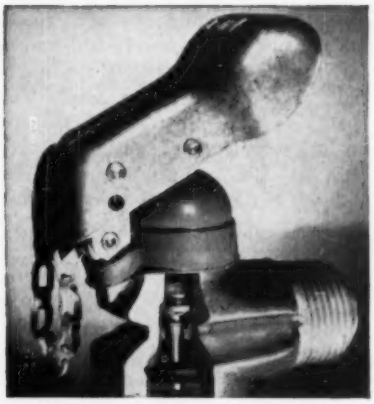

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ANSUL

As a business expands, as living costs rise, more companies decide to start formal salary planning. Here is a helpful approach to the problem of . . .

How Much Pay for Managers?

How much should a manager be paid? This question has plagued executives since the beginning of organized business—from a personal as well as administrative viewpoint.

Salary administration in the end depends on the cold findings of job evaluation—not personality appreciation. But salary scales must be flexible enough to do more than just pay for a job done. Salary is a powerful weapon in attracting new talent, keeping key executives, weeding out misfits. It also must reward a very important man—the professional manager.

No salary plan, of course, solves all problems. But more and more companies are beginning to replace expediency with formal salary-administration programs.

"There is no distinct size a company must reach before it can start salary administration on a formal basis," says a leading American consultant. "It just depends on when management feels it must formalize its efforts." And the consultant has set up plans for companies with as few as 30 employees.

The trend to formal programs has been accelerated by rapid expansion of business enterprises everywhere. At the same time, rising living costs and inflation have confused the salary structure. To make things worse, starting salaries for management and engineering recruits—particularly in nations where technically-trained university graduates are as precious as uranium—have climbed faster than the general range of salaries.

There is little agreement on how to compensate older, experienced managers for the higher starting salaries of the novice. The ideal method, most companies agree, would be to raise everybody's salary to compensate for higher starting rates. But the handful of companies who have tried this say it doesn't solve all the problems.

Most companies are using an expedient known as the merit increase when the problem becomes acute. "Eliminate the seniority idea in relation to value," says one executive, "and you eliminate a lot of today's problems."

Some officials, however, argue that the merit system doesn't solve the basic problems either. For one thing, the system can increase the competitive atmosphere to a dangerous level. For another, merit raises are often based on a man's own starting salary. Suppose a man started at $50 a week five years ago and now gets $120. He sees inexperienced trainees starting at $90 to $100 today. He figures his salary, after five years, has gone up a real $20, not $70 as measured by his starting salary.

These are problems of compensation, though, not of rating. Some companies, up to their necks in compensation problems, confuse the two. Job rating and employee grading are distinct problems.

The first requirement of a rating plan is to hire or train objective, tactful, persuasive analysts—for job analysis can create delicate situations. And department heads should be able to answer questions on the plan. This takes careful briefing.

Then comes the big task. How do you rate jobs? The two most widely used methods are "point scale" and "factor comparison." Point scales—with total scores calculated from a long list of specific elements—are most frequently used for low salary and hourly-paid jobs. With this method, rated jobs are compared by their point scores. (Lists of scale elements can be found in textbooks such as *Wage and Salary Administration*, published by the American Management Association, 1515 Broadway, New York).

Factor comparison depends on developing simple, clearly defined elements—the fewer the better. For instance, General Foods Corporation of the U. S. A. selected three factors to rate its managerial jobs:

Knowledge—What does the manager have to know in general, technical and specialized fields?

Decisions—How complicated and difficult are the situations to which he applies his knowledge?

Responsibility—What is entrusted to him that is valuable to the company—men or products, tools, records, assets, methods, or outside relations. What are the consequences of failure?

Experienced analysts say that a well-conceived plan can evaluate about 95% of the jobs within a company—up to the top echelon.

Job comparisons are best made by the pooled judgment of a group. A number of key jobs, depending on the size of the company, are selected to start with. Then other jobs are fitted into the scale. But there are pitfalls. A narrow spread with many grades gives close control but requires constant revision. A wide spread with too few grades reduces control. Within each grade, a maximum salary 20 to 30% above the minimum should be just about right.

Dividing jobs into grade levels is not so easy. The biggest help in this problem is a principle called Weber's Law. Weber, a 19th century experimenter, was interested in how people perceive the difference between magnitudes. His experiments—using judgments of weight differences—resulted in Weber's Law: "In comparing magnitudes, we perceive the ratio of magnitudes—not the arithmetical difference." Weber defined a recognizable difference

as that point where the difference can be perceived 75% of the time. Thus, in job evaluation, job scales can be divided at the points where a distinct difference in the factors is seen by 75% of the group.

There is still the problem of assigning actual salary figures to the job grades. The local situation and living costs is one factor; and general practice in the industry is a prime consideration. Prevailing salaries for comparable jobs is another—but it is virtually impossible to get adequate comparisons in middle management.

"Prevailing practice" sometimes makes it better to recognize exceptions than to revise an entire rating scale. In this matter, as with all aspects of the rating plan, over-all company policy is the deciding factor.

Job analysis is, of course, a lot of work. But in the end, a rating plan should simplify—not complicate—salary administration.

Here are *Petroleum Week's* comments on how one company—the Sunray Mid-Continental Oil Co., Tulsa, Oklahoma (U.S.A.)—set up a salary administration plan.

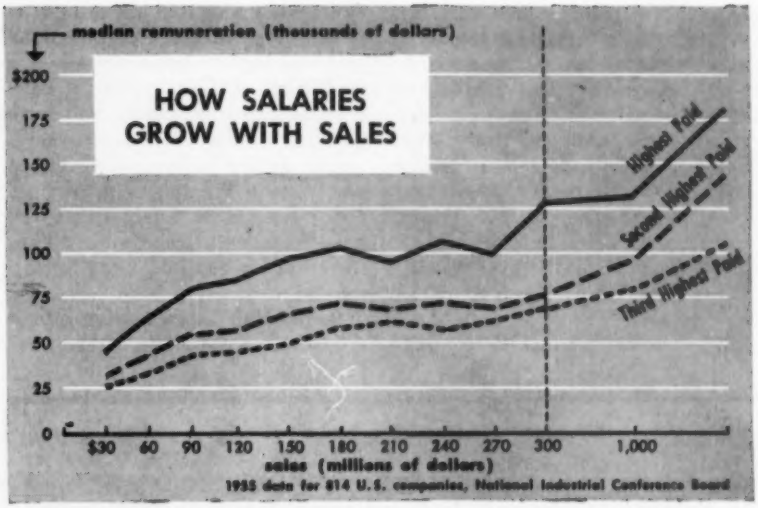
Sunray uses five rating factors: (1) mental requirements, (2) skill requirements, (3) responsibility in supervision, (4) responsibility in job, (5) working conditions.

Job specifications were prepared from questionnaires filled out by supervisors and employees, as well as from personal interviews. Finally, all employees were fitted into 450 job classifications and 16 general salary ranges. Next, a rating committee established salary grades for each classification—with minimum and maximum levels.

Pay raises within each job classification are based on merit. Semiannual reviews are made by each department. And actual wage and salary decisions are made by line managers, with only staff help from the salary section.

Salary ranges are wide enough to give management flexibility. "If it is advisable," a company officer explains, "the top officials on the policy committee can always bypass the salary schedule." ●

Digested from Wage and Salary Administration; Petroleum Week; Business Week, Harvard Business Review.



The Top Executive's Job

When the cold findings of job evaluation are in, there will be at least one man missing—the professional manager who has become the chief executive. His reward can be handsome indeed—many corporations pay their top executives over $100,000. But his job is almost impossible to define.

He has gone past the need for any specific technical or managerial knowledge. His problems are organizational. He works through other people. He is the decision maker, the final boss.

This isolation was described by one new president: "It is one thing to be the man who votes on a proposition or who briefs the president before he makes a decision. It is something else again when you are the man who has to make the decision and stick out his neck."

Another president said that the top executive must, above all, have a "knack of stimulating your fellow workers to better efforts." Though the idea is expressed in different ways, most top executives emphasize this ability. For instance, one president said, "Most of my time is spent creating dignity for and protecting the dignity of first, second, and third level management team members." He has left the competitive ring for the judge's corner.

Once you get to the top spot, you have left behind a lot of intimate friends and it is hard to make new ones. The differences between even the executive vice-presidency and the presidency are great. And the work is heavy and the worries greater.

Outside activities—beyond the business itself—increase sharply. The top executive is a public figure—to stockholders, customers, and the general public.

To handle this job, the top executive needs outstanding qualities of leadership. Three character traits common to most were described by a psychologist-business consultant, writing in the *Harvard Business Review:*

1. **Magnanimity.** Men under them trust them to make decisions in the interest of the organization rather than for personal gain.

2. **Humility.** They have the self confidence to meet emergencies, but they are willing and able to delegate responsibility to others.

3. **Faith.** They are able to settle down within their own inner lives and constantly bring up from within fresh insights into other people, the needs of the market, and the opportunity for greater enterprise and initiative.

Holding such qualifications, it is not surprising that top executives make high salaries. Every industry has salary ranges that are more-or-less generally accepted. And within any given industry, top salaries are generally closely related to a company's sales (chart, above).

The characteristics of the industry play a substantial role in

setting the chief executive's salary. In the United States, the highest paying industries are rubber, (average top salary of $118,000 paid in 1955) primary metals ($116,000), communications ($105,000), petroleum ($105,000), tobacco ($104,000), and chemicals ($101,000). The lowest are construction ($56,000), furniture ($64,000), leather ($66,000), utilities ($67,000), textiles ($75,000).

The rubber industry, for instance, has a double advantage: It is composed of large corporations and is highly prosperous. The textile and leather industries have a lot of small producers, and have had difficult times for several years.

The actual salary, however, is only part of the story. In the past few years, U. S. business papers have reported a trend toward "deferred compensation"—for all top echelon executives.

Bonus and stock option plans are in widespread use. Over 40% of U. S. corporations say they have a bonus system; 40% report stock-option plans. (Stock-option plans allow top executives to buy company stock at a future date at current prices. In other words, the executive can wait for the stock to go up without risking his money). Companies are reluctant to discuss bonus plans, but *Fortune* magazine recently discussed several reasons for their use. First of all, the bonus is meant to act as an incentive and a reward. Secondly, it encourages the professional executive to be "profit-centered," and to develop an ownership attitude. An advantage is that bonus payments are not frozen into the salary structure.

Critics point out that the bonus acts as an incentive for only a short time—executives quickly come to consider it regular income.

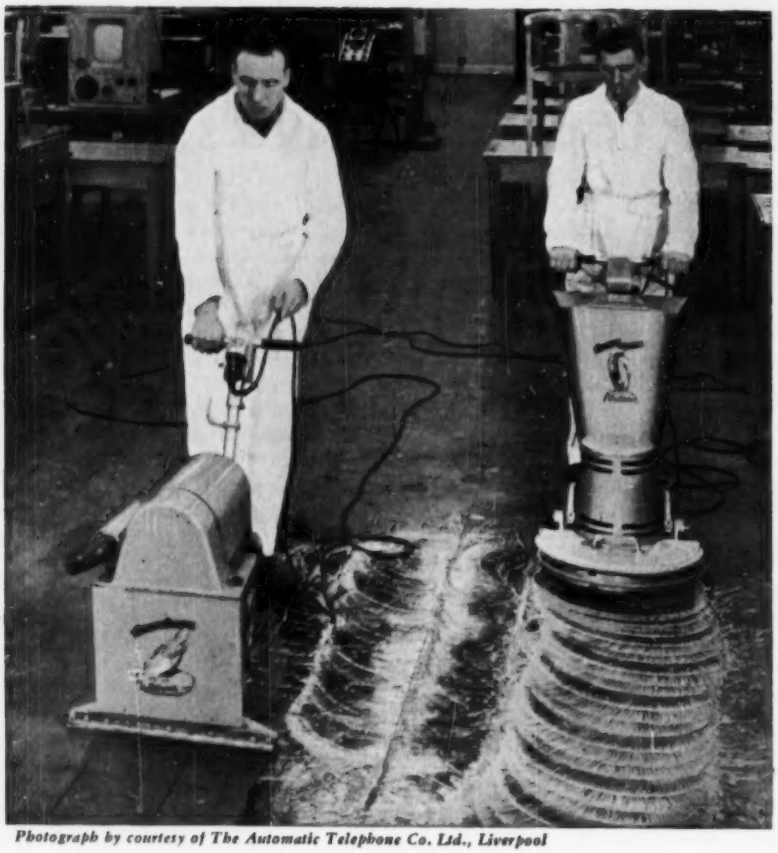
The current trend is towards more discriminating use of bonuses—restricting them to policy makers, tying them to return on capital or increase in stock value. In other words, a "theory" of extra-salary compensation is developing. One company, which has done a lot of thinking on the subject, restricts its stock-option plan to executives under 60 years old—to reward potential value, and its bonus plan to top men.

As with salary, bonus payments generally increase with the size of the company. Thirty-six executives were awarded bonuses of $350,000 or over in 1955. The top man was Harlow Curtice, president of General Motors Corps., who earned $200,000 in salary and $575,000 as a bonus.

In the giant corporations, vice presidents in charge of divisions also do well for themselves. Bethlehem Steel paid its purchasing vice president a salary of $45,000, a bonus of $278,000. On the average, the second in command of American corporations earns 7/10 the remuneration of the top executive; the third man makes 3/5.

Critics often point out there is no sure way to relate a bonus to actual contributions. But top-executive salaries present the same problem. ●

Compiled from reports in Chemical Engineering, Business Week, Harvard Business Review, Fortune.



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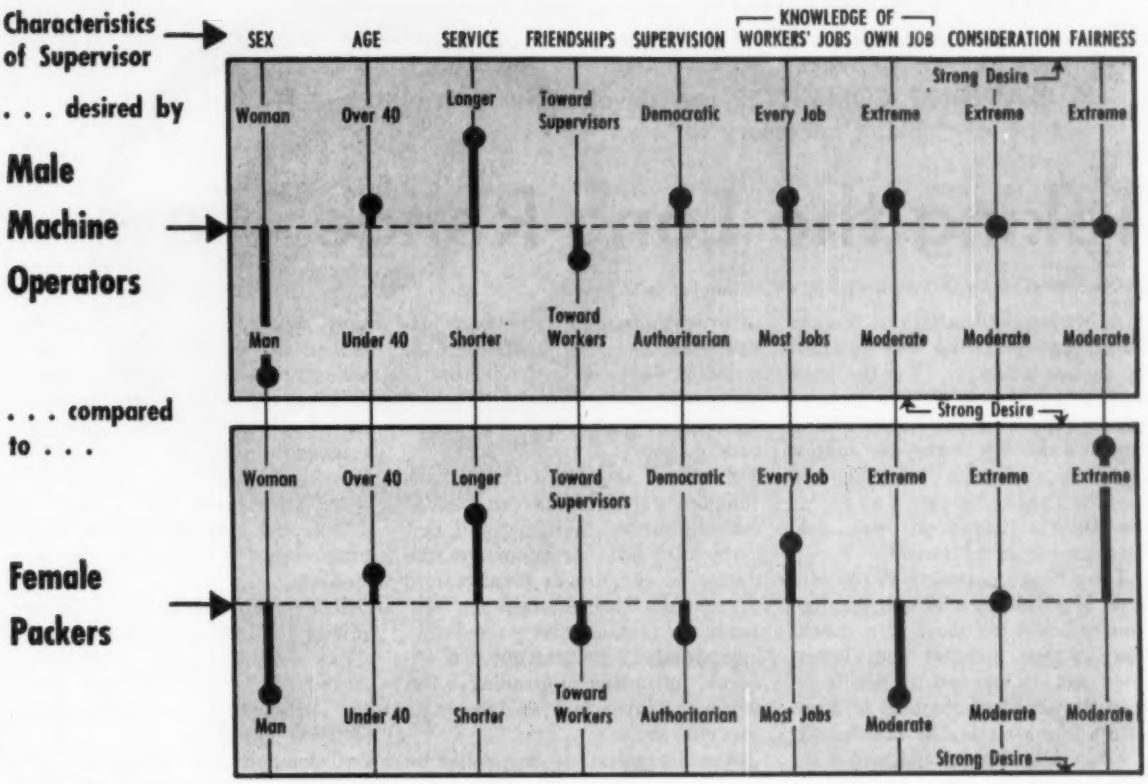

shows that . . .

Sex Makes a Difference

Digested from FACTORY MANAGEMENT & MAINTENANCE, Dec., p.114

Women prefer a supervisor who puts great emphasis on fairness toward workers. Men do not expect as much fairness.

This is one of the sharpest differences between men and women workers, as shown by the preferences marked on the chart above.

As an aid in selecting supervisors, compare the differences in attitudes between male machine operators and female packers. The profile chart is based on a recent study of 4141 civilians at five U.S. Army Ordnance Corps installations. Jobs, situations, and opinions parallel industry, say the authors, psychologists Howard Vollmer and Jack Kinney (*Identifying Potential Supervisors*, College of Commerce, State University of Iowa, Iowa, U.S.A.).

These findings apply to supervisors in general. Individuals, work groups (the report analyses 17 different kinds), and organizations differ. The significance of these differences must be judged in the light of each situation.

But men, almost without exception, want to be supervised by another man. Women also prefer a male supervisor; however, many women have no strong preference.

The chart shows that, on the average, both work groups prefer a supervisor over 40. Both groups, though, had mostly over-40 workers. The worker's age is a major factor. Younger men prefer a supervisor who is under 40 years of age, but they will accept an older boss who is otherwise qualified. Workers over 40 prefer a supervisor who is also over 40. Workers of all age want a boss with at least five years company service.

Employees expect a lot from their supervisor in terms of technical knowledge. In fact, most workers prefer a boss who has a knowledge of every job he supervises. Women expect supervisors to have only a moderate knowledge of his own particular job.

Because a man's success in life is often judged by his success on his job, he takes his work more seriously than a woman, conclude Vollmer and Kinney. A man wants to be consulted by his supervisor. Women prefer to be directed.

A preference for more democratic supervisors increases with the worker's age—up to 50. Over 50, there is a marked reversal in favor of autocratic leadership.

Workers also expect supervisors to seek their friendships among workers, not other supervisors. Among men, this trend, which is of great concern to management, increases with the age of the work group. But women do not take company friendships so seriously.

The psychologists also found that technicians and more highly educated employees care little where a supervisor makes his friendships. One thing they do want is clear instructions. ●

CURRENT PROBLEMS get the attention of most managements. But decisions affect the future.

A PLANNING COMMITTEE can develop the special type of thinking necessary for . . .

Taking the Long-Range View

Digested from HARVARD BUSINESS REVIEW, Jan-Feb, p37

A widespread attitude toward long-range planning was summed up by one manager, "I'm too busy with day-to-day problems to even think beyond the current year's operations. We have to submit budgets, and this takes us 12 months ahead, but that's as far as we go. I'm judged on profit performance year by year."

Long-range planning requires a type of thinking which is strange and difficult for most line executives, whose interest and experience are in operating problems. And the greatest obstacle to long-range planning is the subtle, but occasionally open, opposition of some executives who regard it as a meddlesome intrusion. Hence top management support is absolutely essential before a planning program can make headway.

Planning takes a lot of time, work, and discussion. Plans based on hurried discussions and superficial investigations are a dangerous foundation for committing the company's capital.

Sales and cost forecasting techniques are essential to long-range planning. Many operating managers are skeptical of such "crystal gazing" when first introduced to it.

For a new planning group, the most desirable kind of project is one which poses some operating problems, has long-term implications, and involves the operating experience of several members of the committee. For example: How can we take a new product from the research laboratory through to the market stage. Committee members can learn to work together on such projects.

Another good way to start is to make a study of the factors that will limit the company's growth in the future. This study will require participation by a number of executives. And it will encourage realism. (Being realistic is usually more difficult for sales managers, who tend to be over-optimistic about future potentials.)

Shortage of capital can limit a company's growth, as can lack of manufacturing facilities and raw materials. Another important limitation to examine is management personnel. Planners have a tendency to assume that an existing management organization can undergo unlimited upgrading. Experience proves this is a dangerous assumption.

Another point to remember in setting up a planning committee: the committee's thinking is liable to be more concrete if written recommendations are expected.

Management can discover the strengths and weaknesses of existing departments by depending on people already in the company. Most companies resist the temptation to take the easy course and hire a staff of specialists to do the job.

What can happen is illustrated by the company that hired an economist to draw up a five-year plan. This man worked hard for 18 months and submitted a 450-page volume of hard-reasoned arguments supported by a mass of evidence. He outlined his plan to the board of directors, who discussed it briefly. But six months later, discussion of the report had not been resumed, and, presumably, many members of the board had not gotten around to reading the report.

The lesson of this case is clear. Understanding and confidence in a plan can come only from months of painstaking development by the managers who are concerned.

Practical arrangements depend on the organization of the company. For instance, a company decentralized into divisions—with a general manager for sales, production, etc.—usually finds that it is easy for each division to become a separate planning center. Divisions with the most refined cost systems, budgets, and market research are able to produce more comprehensive plans in the beginning.

Home-office coordination is required to develop uniform yardsticks. One company developed a "standard" outline for each division to follow in its presentation: (1) The Industry, our position and competitors' activities; (2) Sales Forecasts, present products and new products; (3) Capital Investment Requirements; (4) Working Capital; (5) Return on Investment; (6) Location of New Facilities; (7) Manpower Requirements; (8) Management Controls; (9) Pricing Policies; (10) Appraisal of Strengths and Weaknesses; and (11) Special Problem Areas.

An American company with an active planning program charged a senior vice president with heading a committee of six managers—all his immediate subordinates—from product department, purchasing, staff engineering, research, production, and personnel. A junior executive serves as part-time secretary. An outside consultant sat in on the formative sessions in an advisory capacity, but the committee has no special staff.

The committee's task was to develop a master five-year plan that would double sales. First, overall estimates were drawn up for present and future product sales, production and sales costs, etc. Then subcommittees were formed to make special, detailed studies in each area. An outline

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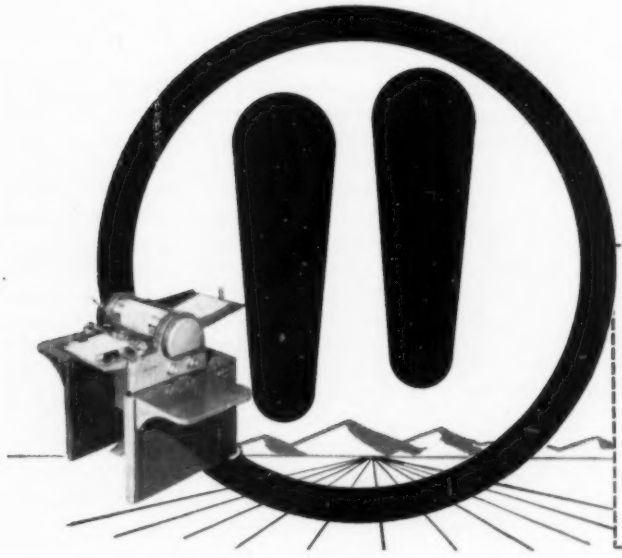

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of how each subcommittee proposed to collect its data was submitted to the full committee.

A tentative five-year plan was drawn up, but it took two years to turn the plan into operating policy. The final stage was to compute total capital requirements for new facilities and working capital requirements. Crude calculations of return on investment were made at many stages to test the feasibility of individual projects—and these were gradually refined as more data became available. Finally, a projection for the last two years was added.

Each year the remaining four years is reviewed and another year's projection added. Thus a five-year plan is perpetual.

The committee is now able to spend most of its time refining projections and making detailed studies of proposals with long-range implications.

Operating personnel were selected for the planning committee in another company—but their operating duties were taken away so they could devote their full time to planning. A master plan can be drawn up faster with this approach, but there is a defeating disadvantage. The committeemen quickly come to be regarded as staff men, and lose much of their influence over line managers.

Another company with centralized management assigned the highest ranking assistant to the president to head its planning committee. The committee is composed of all 15 vice presidents. Its objectives are limited to considering specific projects and a subcommittee is formed to investigate each project. An assistant vice president acts as liaison.

Today's planning must consider many factors. And it takes men with real management breadth to assign proper weights to the many different considerations. That is why top management must be involved. Planning has many frustrations, but perhaps the worst is to see top management making major commitments for a company —while failing to recognize or ignoring the long-term implications which a planning group could help to clarify. ●

Evaluating the Suggestion Plan

"Do they work?" Big Dutch companies say "Yes." But smaller firms aren't so sure.

Suggestion boxes have multiplied like rabbits in plants all over the world. But they are most successful in large companies, according to a survey of Dutch management.

While a few Dutch companies have had employee suggestion plans for up to 50 years, a vast majority—70%—were started in the past five years. Practically all of the larger (over 1,000 employees) companies have plans. So do a majority of medium-sized (500-1,000 employees) concerns and many of the smaller firms.

The answers to one question sums up the suggestion story: "Are you satisfied with the results of your suggestion box system?" Not a single big company answered "No." In the smaller firms, "Moderately" was the favorite answer—but "No" got almost as many votes as "Yes."

Since actual savings are usually larger in a big operation, larger companies can pay larger awards for the best suggestions from employees. The Dutch survey shows that they do. On the other hand, smaller companies tend to accept more suggestions—so they reward more of their employees with less money.

Accepted suggestions brought an average of 27 guilders (about $7) to Dutch workers in 1955. But the range was tremendous—from five ($1.25) to 2,250 guilders ($5,600). And the award ceilings (the highest award allowed) were just as wide—10 to 9,500 guilders. A figure for comparison: skilled workers in Holland earn an average of 85 guilders ($22) a week.

Big companies also get more intangible returns from a suggestion system. Morale and communications problems are greater for them and a suggestion system helps with both problems.

Administration varies greatly from company to company. But Dutch experience points out some general procedures:

—Almost all the firms relied on the three "Golden Rules of Management" to introduce their system—(1) get the cooperation of top management, (2) instruct middle and lower management, and (3) consult employees' representatives. In most cases, the system was introduced by the top executive.

—Three quarters of the companies have a committee to judge suggestions. The chairman is often a member of top management, and the foreman concerned with the idea is usually consulted. A quarter of the committees include employees' representatives.

—About half the firms depend on a clear-cut procedure with special forms. Most, but not all, have suggestion boxes. A third of the firms handle suggestions anonymously. And three out of four acknowledge receipt of suggestions.

—"Encouragement" awards are made by many companies for good ideas that are not adopted. Such awards are especially useful during the early stages of a program. Special prizes are widely given for the best production idea for the year, the best safety suggestion, etc. Certificates are sometimes awarded, too.

—In addition to award formulas (such as a percentage of the estimated savings for one year), the man's job is taken into consideration. His normal task is a factor; and higher rank usually means less reward for suggestions.

A Suggestion Box Center in the office of the Netherlands Institute for Efficiency, Laan van Meerdervoort, The Hague, offers help to Dutch companies interested in starting a suggestion system or with problems. The Center is interested in exchanging information, and will send a full report on its survey to MANAGEMENT DIGEST readers. ●

In Management

● **INTERFIRM COMPARISONS can be an effective aid to management,** delegates to the Harrogate Conference of the British Institute of Management agreed. But they said that smaller companies in Britain lack comparative guides that large companies can get from their various branches. A firm's primary ratio of return on capital should be compared to the ratio for its industry as a whole, the delegates pointed out. And other comparisons—financial, expense, and operating ratios—should also be made. But the first difficulty is to persuade manufacturers to supply data for industry-wide calculations.

The delegates noted that universities and private organizations make comparative surveys in Germany and Switzerland, with cooperation from industry. (*The Times Review of Industry, Dec, p*14)

● **ELECTRONIC COMPUTERS are not a magic answer to office work.** When General Electric installed a large computer in its appliance division at Louisville, Kentucky (U.S.A.), the company estimated its payroll for 8,500 workers could be done in two hours. It estimated that all three jobs chosen for conversion—payroll, billing, and accounting—would take only about 10 hours. But two years later, the payroll alone takes 20 hours. And the other operations have just begun to get attention.

● **"HOW CAN WE GET OUR FOREMEN TO DO A BETTER JOB?"** A recent study of the American Management Association's Supervisory Development Service indicates that the answer may be a simple "Let them."

Here's a typical finding from the 66-company study: More than 80% expect foremen to discipline employees but less than 50% permit them to demote or discharge for cause and only about 35% allow foremen to award merit raises.

Except in the handling of employee grievances, an area in which most firms do grant him the needed powers, the foreman's authority lags behind his responsibilities.

▶ YOU AND YOUR PERSONAL AFFAIRS

"This work gives me a headache" is a complaint that can mean anything from laziness to lack of ability. But according to the author of a new book called The Stress of Life (McGraw-Hill Book Co., New York, $5.95), it can have real significance as a simple statement of fact.

Stress—the "wear and tear" of life—has particular meaning for the business executive, often under tension and plagued by the threat of ulcers, "heart burn," and a host of minor ailments. A man has just so much energy available to adapt to stress. And exposure to stress uses up this energy. The length of human life itself depends on the amount of this available "energy of adaptation." We don't know exactly what this energy is, says author Dr. Hans Seyle, Viennese-born director of University of Montreal's Institute of Experimental Medicine. But it is basic to life.

Dr. Seyle's conclusions offer no new handy rules to help the harried businessman solve his personal problems. But they are based on 20 years of basic research in physiology. And physicians around the world who specialize in "stress diseases"—heart trouble, stomach ailments, etc.—are following Seyle's work with keen interest.

It is not just germs or poor organs that bring on sickness, according to a "unified-field" theory of disease developed by Seyle. Rather, it is a man's own glandular system—as it adjusts (or over-adjusts) to the tensions of everyday life. The secret of health, says Seyle, lies in successfully adjusting to ever-changing stresses without plunging overboard on any one of them.

Seyle's research findings will come as no surprise to the ulcer-prone businessman. In experiments with rats under tension, he found that the inner lining of the stomach—along with the adrenals, thymus gland and lymph nodes—is particularly sensitive to stress.

In his own words, "The discharge of ACTH (a hormone of the adrenal cortex), the enlargement of the adrenals, the involution of the lymphatic organs, the corticoid-harmone content of the blood, the feeling of fatigue, and many other signs of stress can be produced by activity or injury in any part of the body." In simple language, this means a man can get completely churned up inside from a simple, apparently unrelated and external, cause.

Since man cannot avoid stress, Seyle's advice is to try and keep damaging side effects to a minimum. He puts a good deal of hope in what he calls the "defense mechanism of diversion." In other words, worrying thoughts cannot be simply driven away. They must be replaced by pleasant thoughts. And Seyle thinks that people can consciously do this. Sports, dancing, reading, music, even light drinking are good ways to restore balance. Other ways:

Consciously keep yourself from getting keyed up more than is necessary for your best work performance.

Unburden yourself of irrelevant details as soon as possible.

Avoid exhausting repetition of work or thought.

Escape is not the final answer. Seyle's book is dedicated to those "who are not afraid to enjoy the stress of a full life, nor too naive to think they can do so without intellectual effort."

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Food Packagers Look to Flexibles

The world's biggest industry is food, and food's most important satellite is packaging. Today flexible materials for packaging hold the most promise.

Digested from FOOD ENGINEERING, Special Report

Ever since the first fish was wrapped in a palm frond for temporary safekeeping, food suppliers have been the packaging industry's prime customer. As food processing has advanced, so has packaging. And the reverse is true: Occasionally packaging advances have made possible new food preparations.

Now, the packaging world is in the midst of a revolution—built around a new order of synthetic and natural "flexible materials." These "flexibles" present the food industry with new opportunity—not only in improving flavor and quality, but in drawing the customer's attention and holding his interest in the retail store.

And what the food men are doing is being adapted by makers of other products: Everything from nuts to bolts to stockings and underwear are showing up in flexible material packaging.

In the food industry you will find flexible materials going into wrappers, carton liners, bags within cartons, bag liners, paperboard liners, carton windows, carton inner-wraps, pouches, and packets—as well as labels, inserts, dividers, and fluted cups. And the flexibles are being adapted to low-cost operations on high-speed packaging lines.

Processors have come up with the new technique of inhibiting spoilage by antibiotic treatments (of vital interest in areas where storage facilities are just not adequate), and they are researching into radiation "pasteurization" (MD, Feb, p28). In both cases, flexibles promise to play a key role.

Such materials as antioxidants, mold inhibitors, and insect repellents added to flexibles prevent, or at least slow down, food spoilage. Low-cost coated papers treated with Lindane or methoxychlor, for instance, show promise of checking insect infestation.

A great deal of creative talent is searching out new and better flexibles and new and better ways to use them. In particular these are the areas under investigation:

—Laminating, coating, and printing of a variety of papers, films, and foils.

—Suitable coatings, laminants, and inks—as well as methods for applying and drying them.

—Thermoplastic materials, compounds, and heat sealing.

I. Look to Combinations

Meanwhile the flexibles, themselves, are getting better. And while no one paper, film, or metal foil has the functional properties to fill all packaging needs, what one lacks often can be compensated by laminated combinations of films, or by coatings.

You can make the package suit your product requirements if you study the large variety of flexible materials and equally large selection of coatings and adhesives. These can be fabricated into a composite material with desired protective and performance properties. Coatings may be applied to papers or plastic sheets. Any combination of papers or films can be laminated to one another or to foil. Or they can be coated and then laminated in just about any set of combinations. Here are some major types of combinations:

—Two hard-faced sheets—like glassine laminated to cellophane or to cellulose acetate.

—Open- and hard-faced sheets—such as kraft, paperboard, or sulfite paper bonded to glassine or parchment.

—Two open sheets—like lightweight sulfite or kraft papers.

Special coatings can be applied to base materials to get any one or a combination of additional properties—a heat-seal closure, improved printing surface, moisture vapor barrier, enhanced eye-appeal, exclusion of foreign odors, and retention of desirable aromas.

The coatings are made up of molten waxes of many kinds, hot melts, modified rubber, polyethylene, vinyl, and solvent-type nitrocellulose. Each has its own specific properties, appearance, and degree of protection.

II. Paper's Potential

Many packaging-material combinations can be produced from papers and thermoplastic resins. For example, take the oldest and simplest coating—paraffin wax. Applied to glassine, this hot melt gives it gloss, water-repellency, moisture-vapor proofness, and some heat-sealability. Modify paraffin with resins (heat-treated rosin and hydrogenated rosin ester) and friable film formers (butyl rubber or poly-isobutylene) and you have a coating that improves the scuff resistance, gloss, and heat-sealing properties of glassine.

Today, the polyethylene-coated papers are most important. For one thing, polyethylene's cost is low, and it has good coating characteristics, good aging and heat-sealing properties, and resistance to moisture, moisture-vapor, and chemicals. Flexibility is retained in the −24°C. to 95°C. temperature range. Here are some recent interesting applications of polyethylene-coated papers:

—As wrappers — especially where the polyethylene surface is in contact with frozen foods and, thereby, serves as a releasing agent upon unwrapping.

—An aluminum foil, paper, and polyethylene combination as a wrapper for hygroscopic products.

—Polyethylene-coated cellophane for meats, seafoods, dessert mixes, confections, olives, pickles.

—As the inner ply for waterproof multiwall bags.

Food packaging papers continue

to be improved. Advances in paper-making techniques are adding better properties. For example: Water-repellency is being increased by adding stearatochromic chloride. Chromic fluoride improves grease resistance and water repellency. And resins and latexes add strength, flexibility.

III. Packaging with Plastics

Fastest growing plastic packaging material, and second in volume to cellophane, is polyethylene. It is compatible with certain other plastics, and may be compounded to extend its usefulness. Additives such as resinous waxes, butyl rubber and S-polymers form it into films with moisture-vapor and grease resistance.

Besides heat-shrinkable polyethylenes there are polyethylenes that are extrusion-oriented to make them stretchable. Bags from such materials "cold-stretch" so products can be packed into them in a skin-tight fit without immersion in hot water. Pinhole-free tubing—valuable for packaging liquids—is another use.

Although not a new material, interesting things have been done with Saran (vinylidene chloride). On a gage-for-gage basis, its moisture-vapor resistance is almost five times higher than any other self-supporting film. Other properties include: crystal clear transparency, low gas permeability, toughness, resistance to aging, self-clinging, and chemical resistance.

Saran-coated Mylar (polyester film) might supplement tin in tin-plated cans. It may even eliminate certain can lacquers. But this combination tack-seals and will not hold a vacuum-seal like a cellophane-polyethylene pouch. However, when you apply polyethylene to Saran-coated Mylar, the composite has polyethylene's sealing properties, Saran's proofness to gas and moisture vapor, and Mylar's strength.

Cast vinyl is another material with useful packaging properties. Some vinyl types are non-toxic, and so can be used in direct contact with food. But cast vinyl is used principally as a lamination to other packaging materials.

Unplasticized vinyl is worth watching. It is rigid, thus lending itself to vacuum forming to fit irregular-shaped food products.

IV. Better Laminated Cartons

Improvement in the laminated construction of cartons shows much promise. Until recently, most cartons were wax coated. But the fragile, coated surface scuffed and cracked. Flexibles—laminated to cartons—could play an increasing role. These make containers which will hold oils, brines, syrups, and fruit juices without leaking.

One- or two-sided foil-laminated cartons are moisture- and grease-resistant. This combination can be opened to form a rigid, spill-proof, "heat-in" carton. Polyethylene-coated paperboard will compete with other materials to provide greaseproof boards. The reason is that the extrusion-polyethylene-coating technique has overcome certain gluing and handling problems common with other laminated paperboards.

V. Ahead: Better Machines

Some materials—like Saran, Mylar, and cellulose acetate—could not have found extended applications except for the development of machines to overcome their heat-sealing deficiencies. Efforts will continue to step up speeds on carton over-wrapping machines from the present 200-250 per minute to over 400. Machines will be of the continuous-motion type, with fewer moving parts and better control of free-flowing sheets.

The trend is away from the use of preformed single pouches. Instead, pouches are being fabricated from roll-stock, filled, evacuated (or gassed), and heat-sealed. Straight-line, multi-function machines that make portion-controlled packets are becoming more popular.

Free-flowing solids, along with liquids and pastes, can also be portion-packaged. They are volumetrically fed into roll-fed machine-stamped foil pockets at over 700 per minute. Then thin film is sealed over the multi-pockets, and these are machine-stripped into individual packets. ●

Checklist for Flexibles

Here are some of the things you should check when you look for the flexibles most advantageous for your products and most suitable for your own processing operations and marketing range.

Which material? Types are paper, film, foil, coated, or laminated.

In what form is it available? Rolls, sheets, or converted form should be considered.

How flexible is it? Some materials are very flexible, others are not.

Does it protect against light? Light rays can damage foods.

It is water-resistant? Some materials have high wet strength. Others must be treated.

What about grease resistance?

It it impermeable to moisture? Material that is a good water-vapor barrier prevents dehydration of moist products and moisture pickup by dry ones. Property can be controlled to suit product.

How about resistance to chemicals? Salt, for example, corrodes aluminum foil.

Is it odorless, does it affect product taste, and is it inert?

Do fungi or bacteria act on it? Or does it support growth of other infestation? Is it insect-resistant?

What about humidity. Does it crack in dry weather? Does high humidity cause it to go limp, become "sticky?"

Is it heat sealable?

Does it shrink to conform to shape of product?

Can it be used for vacuum or inert-gas packaging? Product shelf-life is extended by this technique.

Can it be laminated? Through lamination, some shortcomings may be offset.

What about machinability? Does it handle easily on high-speed machines?

Is it favorable as regards yield and cost? Compare the film's cost/1000 square centimeters of specific gage with that of other materials.

Has it pinholes? In such material as foil, for example?

Is it compatible with adhesives, lacquers, coatings, plasticizers?

Will it hold liquids, oils, viscous products?

For More Information Write . . .

Institut Francais de L'Emballage et du Conditionnement, 3 Rue La Boetie, Paris 8, France

Packaging Division of the Printing, Packaging & Allied Trades Research Assn., Patra House, Randalls Rd., Leatherhead, Surrey, England

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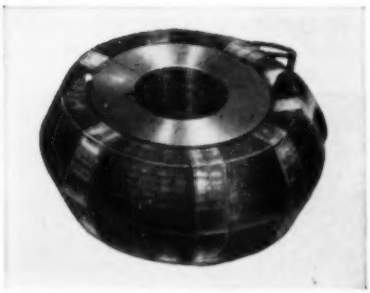
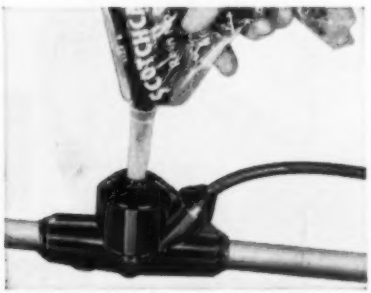
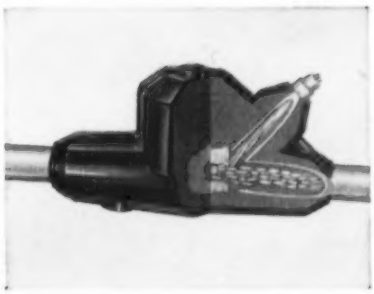


IN THE PLANT, electrical components can be easily sealed in "SCOTCHCAST" on the production line. This 10 in. coil, for example, has a tough, strong eighth-inch thick jacket.



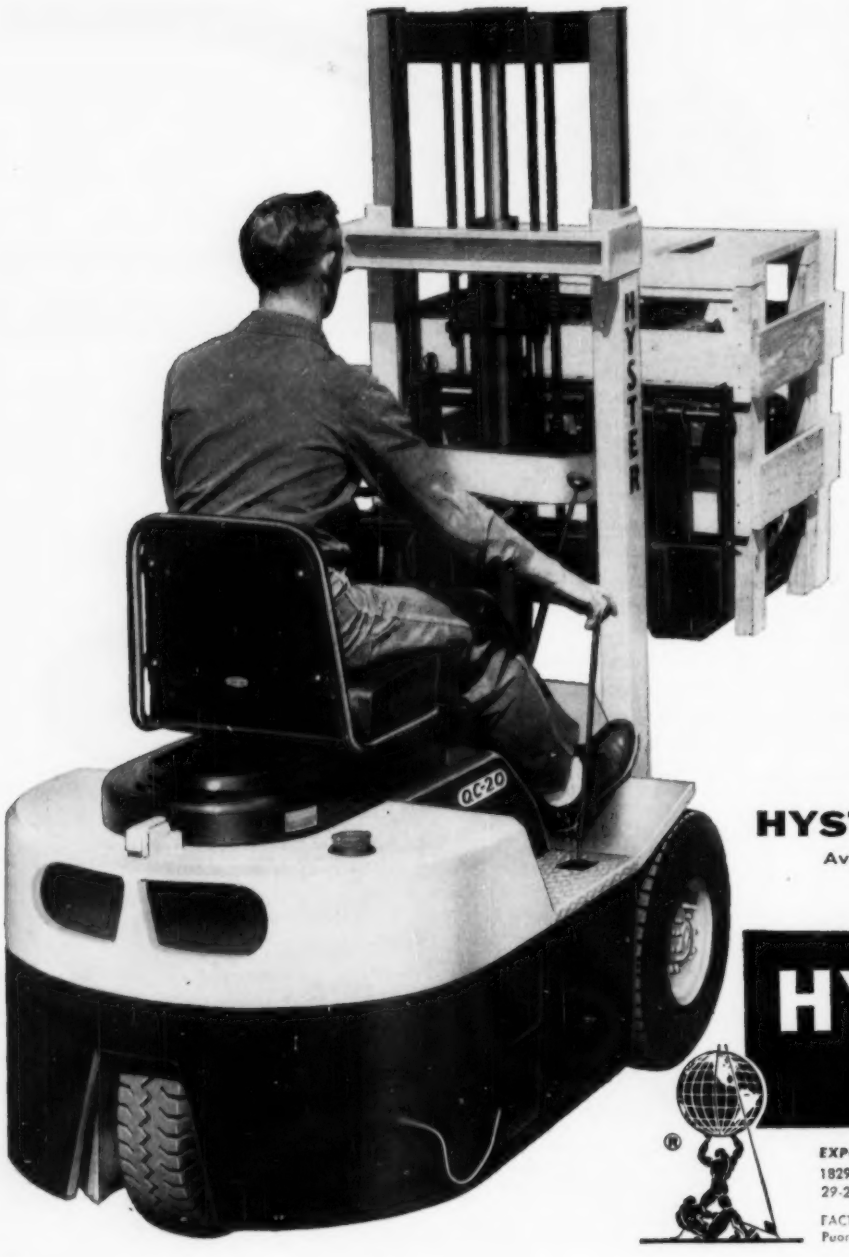
IN THE FIELD, "SCOTCHCAST" Splicing Kit gives a factory-perfect splice in minutes. Simply connect wires, pull plastic mold units into place, pour in "SCOTCHCAST."



CUTAWAY OF SPLICE shows how "SCOTCHCAST" provides complete moisture barrier, seals splice tight. "UNIPAK" Container in kit speeds mixing of resin and activator — any time, any where.

Made in U.S.A. by MINNESOTA MINING AND MANUFACTURING COMPANY, International Division, St. Paul 6, Minnesota

THE NEW HYSTER 20 GETS MORE WORK DONE PER DAY THAN ANY OTHER 2000-LB CAPACITY PNEUMATIC



Briefly, here is why you should *look further* into the Hyster 20. Like all Hyster Lift Trucks, the 20 is designed by men who have had long experience in the manufacture of materials handling machinery, aided by Henry Dreyfuss, noted industrial designer. The result is a truck with an *unusual capacity* to get more work done per day.

Operator can better see what he is doing and can maneuver in greater confidence *inside*, and *outside*, under all operating conditions, and in closest quarters.

Less time is spent in servicing and repair because the Hyster 20 is *designed* for more time on the job. We can't possibly begin to tell you all you should know about this truck—but call your Hyster Dealer. He will give you the entire story. If you move materials of any sort, you owe it to yourself to look into the very definite advantages of using the new Hyster 20 Lift Truck, or any of the other Hyster Industrial Trucks 1,000 to 30,000 lbs. capacity.

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This pilot plant produces . . .

Profits from Chemical Junk

With the help of a new pilot plant, Hird Chemical Refining Corp. (East Palo Alto, Calif., U.S.A.), is seeking new ways of turning the abundant wastes of other people's chemical processes into salable chemicals. Several possibilities will be studied:

—Transformer oil recovery is now being done by a 2-step method of heating (to drive off water) and clay absorption of impurities. Hird's goal: a continuous process.

—Recovery of decolorizing plasticizers.

—Reclaiming of rolling mill lubricants.

—Lube oil recovery on a continuous, fully automatic basis.

—Reclaiming of rubber in a form other than rubber.

A by-product of the pilot-plant might well be a consulting and licensing business. Hird says it is willing to sell its techniques to any company with a waste-chemical disposal problem, and to license its processes to reclaimers.

Hird finds some new-material suppliers reluctant to accept its reclaimed chemicals. Even though the reclaimed chemicals can meet exacting purity specifications, potential customers sometimes are shy of such materials. So Hird buys chemical junk for recovery, sells back only that portion the customer can reuse, and retains any other valuable components for sale to others. (*Chemical Week, Jan* 19, *p*66)

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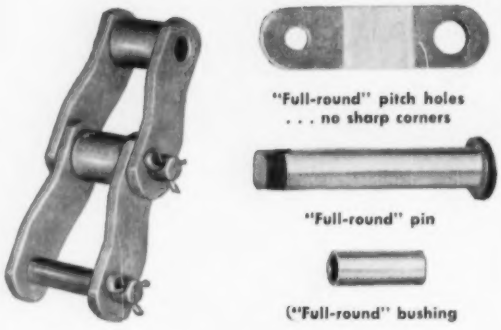
"Stress raisers" eliminated by Link-Belt LXS chain design

LXS "FULL-ROUND" DESIGN



"FULL-ROUND" DESIGN eliminates stress concentration points. Heat treatment of all parts adds even greater strength and extra wear life to selected steels. Accurate control of these processes avoids brittleness, poor wear values and low tensile strengths . . . and assures uniformity.

Large pins, bushings mean ample live bearing area for long life

For long life under severe conveyor and drive conditions, Link-Belt LXS chain provides extra strength, increased wear resistance and wider application flexibility. This fabricated steel roller chain incorporates many advanced design and manufacturing refinements, resulting in superior ruggedness and accuracy.

Eliminate weak points

"Full-round" design does away with stress concentration points most frequently subject to failure . . . provides maximum live bearing area between pin, bushing and sidebars. As a result, stress is distributed evenly, increasing chain life.

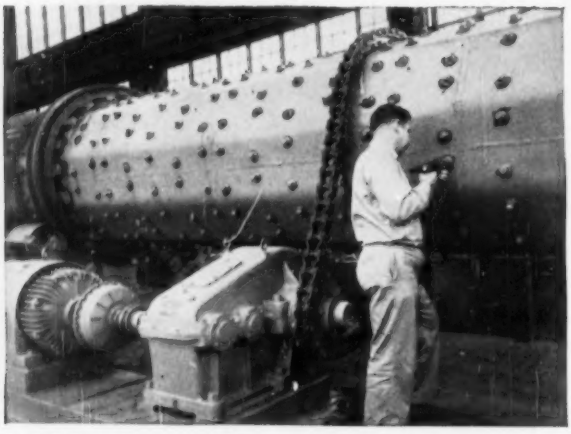
Pins and bushings are accurately sized for controlled press fit, preventing rotation in sidebars. Made from selected bar steel, sidebars are carefully machined for proper pitch hole size and for maintaining firm, tight press fit of pins and bushings. This assures close control of pitch and proper chain length after assembly.

Hardening extends life

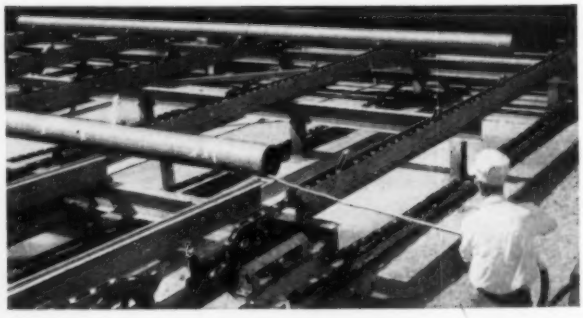
Another Link-Belt long-life extra is the controlled hardening of selected steels used in the manufacture of LXS chain. Pins, for example, are made from a tough steel, specially treated for high strength in shear and for maximum wear value. Bushings are properly hardened to shrug off shock and resist wear.

Rollers are accurately machined to assure proper operating clearances and free-rolling action. Controlled hardening gives them the necessary resiliency and durability.

LXS especially popular for exposed drives, high impacts



Link-Belt LXS chain is the long-life answer for exposed drives, abrasive and high-impact conditions. Its large, live bearing area reduces cutting action of abrasives because load is spread over a broad area.



LXS chain provides extra strength, wear-life for heavy-duty conveying

Link-Belt LXS chain has real stamina—as shown in this conveyor application for handling 1000-pound, 40-foot lengths of steel pipe. Thanks to accuracy of pitch and attachment spacing, plus close matching of multiple strands, LXS has the added strength and wear life for the extra-long conveyors so popular in today's move to mechanization.

For help with any chain problem call your Link-Belt representative. Send for 342-page catalog 950 covering the complete line of standard Link-Belt products for conveying and power transmission.

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14,258-E

How Decisions are Made With Logic Functions . . .

Should You Smoke? ⟶

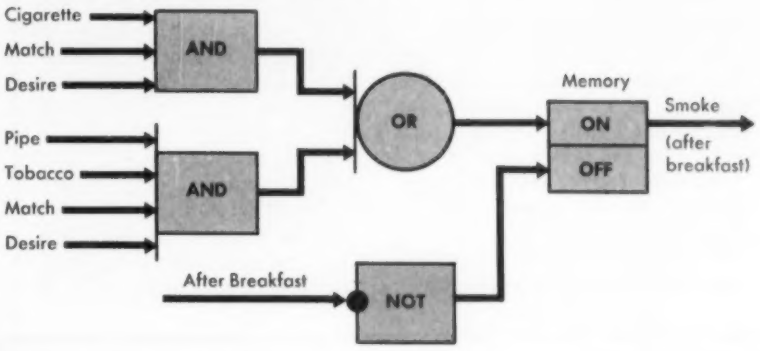
Logic functions not only can be used to meet any control problem, but are involved in processes of all types. As an example, look at the logic process involved in a man's decision to have a morning smoke. You will find it programmed with logic elements (right).

To smoke a cigarette, the man must have the cigarette AND a match AND the desire to smoke. Thus, an AND element with three inputs is required. But, the kind of smoke is not specified so a pipe must also be considered. (This man does not smoke cigars until after lunch). Again, he must have a pipe AND a match AND tobacco AND a desire. This time a four-input AND element is required.

However, our friend will not do both at once, hence to select one or the other, we must feed the outputs of the two ANDs to an OR element. Like most men, however, this man will NOT smoke before breakfast. Here a NOT element is required to produce a signal at all times when no input (breakfast) is present.

Now with the output from the OR we can supply an "on" signal to a MEMORY element and with the output from the NOT we can supply an "off" signal to the same element.

Thus, we get an output from the MEMORY—and consequently a smoke—only after the man has had breakfast. The mind performs these functions in arriving at every decision.

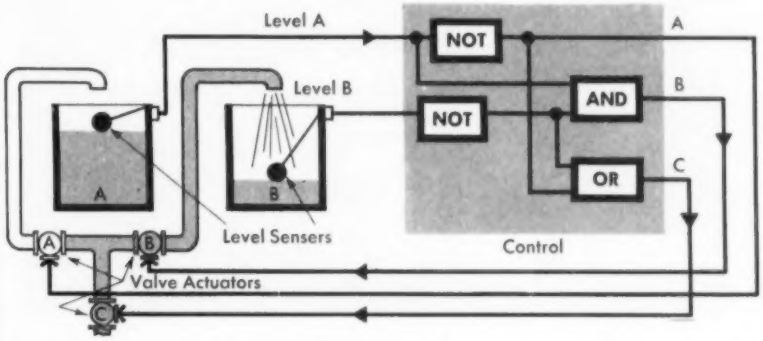


Controlling Flow ⟶

Two tanks in a central coolant system must be filled in a specific sequence. Tank "A" must be filled first and tank "B" can be filled only if tank "A" is full. The tanks are separate.

The sensing elements are level sensers in each of the tanks, which deliver an output when the tanks are full. Immediately, the characteristic of the level sensers suggest that a NOT element must be used to detect when the tanks are not full. Hence, the inputs from the two level sensers should be fed to two separate NOT elements. But the stipulation is that tank "B" be filled only when tank "A" is full, and when tank "B" is not full. Thus, the output from the NOT element associated with tank "B" and the output direct from the level senser for tank "A" should be put through an AND element. This part of the control says, if "A" is full AND "B" is not, "B" will be filled. A common valve is also added, which will also operate when either "A" or "B" is empty. This means an OR element fed by outputs of two NOT elements.

Problems of this nature can be solved by simple, commonsense logic. More complex systems, of course, require more study, but the basic concepts remain the same.



A New Approach to Industrial Control

Digested from AMERICAN MACHINIST, Dec 17, p139

Signals are the one common and indispensable ingredient in all industrial controls—in fact in all controls including those determining the functions of the human body. These signals contribute to positive decisions. One way to describe how decisions are made is through the four logic functions.

A logic function is simply a means of expressing a definite condition. The four functions express any possible condition, set of movements, or specific arrangement of information. These functions are: AND, OR, NOT, and MEMORY. Know how they operate, and you have an important method for solving problems in automatic operation and process control, and a major device for finding the most direct method of control.

In the "AND" function an output signal is produced only when **all** of a given number of input signals are applied. In other words, given input signals a and b and c and d and . . . . . j, the AND function delivers an output signal—causing some action to occur.

In the "OR" function an output signal is produced when **any one** of a number of input signals is present. Hence, given any input a or b or c or d or . . . . . j, the OR function delivers an output signal.

With the "NOT" function, an output signal is obtained when **no** input signal is present. Therefore, given an input a, no output occurs; but stop input a and the NOT function delivers an output signal.

"MEMORY" is the fourth function. Actually there are two kinds of MEMORY functions—a limited function and an unlimited function. Limited memory means that, following an input signal, there is a specified time delay before an

"This approach opens vast areas . . . for tomorrow's manufacturing systems."

output signal is obtained—or after which no output is produced. The unlimited memory function delivers an output following an input signal until a second input is fed into the system; the second input stops the output. This function delivers an output until the next signal, input b, is applied.

To give you an idea of the really basic nature of logic functions, many scientists believe that the human mental process behaves in logic-function fashion. Any decision, whether as simple as "Will I walk or drive?" or as complex as "Shall I change my way of living?" is analyzed and determined by these functions.

Either a series of conditions, a choice of conditions, a negative influence, the memory of a previous experience, or a complex of all four functions, will decide the action you take. However, a single decision may involve variations of these four functions repeated thousands of times until all of the factors (inputs) are sifted down to the final output—your decision. This process may take only a fraction of a second or many hours and days.

In operating a machine tool by hand, the machinist's every action is determined by these four logic functions occurring in his thought processes. Knowledge and experience simply determine which elements must be present and which functions to use. Thus, for automatic operation of the machine the functions processed by the brain are handled by an instrument. These instruments cannot "think." They only make decisions based upon information previously placed in them and the arrangement of the decision-making elements.

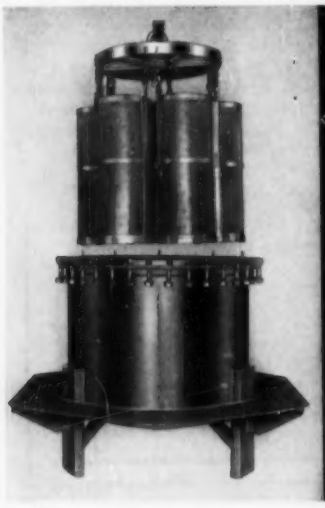
Signals are the information carriers which make up both the quantity in which operations must be performed and the means by which operations can be performed. Signals are amplified, transmitted, or switched. They also actuate control mechanisms and match systems or sections of systems. In so doing, signals form the basis of industrial control.

Signals actually take one of two forms: "analog" or "digital." Electrical systems, equipment, and even design approaches are largely classified under these two headings. Logic functions are primarily concerned with digital control.

The "digital" signal is a single, sharp, discreet signal of definite duration. The "analog" signal, on the other hand, is continuous, and gives a continuous representation of (is analogous to) some quantity or process. The signal from a switch is digital; the signal from a tachometer generator is analog.

Practically all machine tools and most automatic processes receive some measure of digital control through logic-function systems. Most of today's "giant brains" operate by means of logic functions.

While the concept of these functions is not new, the use of the



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logic-function approach to designing industrial controls is new. And this approach opens vast areas of understanding for tomorrow's manufacturing systems.

Logic function mechanisms now available permit systems designers to solve complex problems efficiently while simplifying present circuits and circuit concepts.

In the U. S. A., Westinghouse Electric Corp. has had logic-function devices on the market for some time. General Electric Co. has just announced its "Static Switching Systems" which depend on logic functions for operation.

Westinghouse's units are called "Cypak" (MD, July '56, p23). They contain no moving parts and can be plugged into a circuit to perform a certain function. All of the four functions are available.

Several types of equipment are now controlled by Cypak elements. For instance, Micromatic Hone Corp.'s (Detroit, Mich., U. S. A.) Model 738 Microhoner is a completely automated machine that generates a bore square with the end faces of a piece, to provide accurate locating surfaces for subsequent operations. Cypak controls these operations:

—Automatic feeding and aligning of parts.

—Automatic sizing.

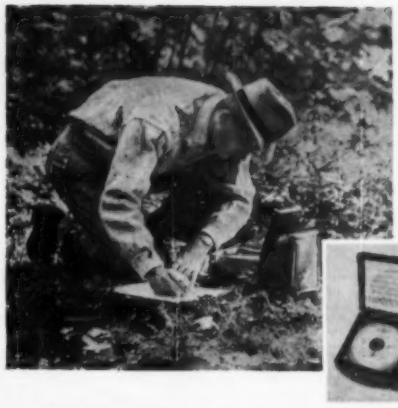
—Automatic after-gaging via standard air spindle and pneumatic-to-electric transducer.

—Automatic segregating of parts, according to bore diameter, as they leave the machine.

—Automatic stone-wear indication.

—Automatic shutdown when abrasive is exhausted or if a predetermined number of parts are out of tolerance.

Logic-function control of this machine and machines and processes still to come marks an advancement in the concept of modern manufacturing. You don't have to look too far for the reasons: One of the major problems of automatic control will be the maintenance requirement. Another problem will be control packaging—getting all of the equipment necessary for automatic control into a practical amount of space. The logic-function devices already available simplify both problems. ●



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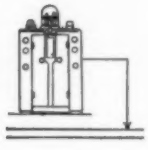
The W&T Sensitive Altimeter, shown above, was used on a reconnaissance survey where quick, accurate results were required. The W&T Altimeter was chosen because of its dependability, rugged durability and high order of accuracy. These qualities are typical of all W&T's aneroid and mercurial pressure sensitive instruments, many of which are used in exacting research work and production testing.



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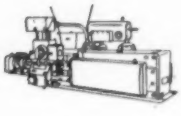
Equipment includes chlorinators of both the water and mechanical diaphragm types in all capacities, hypochlorinators, and many other auxiliary and accessory items designed for use in the treatment of water for sanitation as well as for numerous industrial purposes.



PROCESS FLOW CONTROL

Equipment includes chemical solution feeders, gravimetric and volumetric dry feeders, and gravimetric meters for use in the chemical, grain, and food processing industries.

AIDS TO NAVIGATION

Includes a number of protective devices for navigation such as buoys, lamp changers, flasher mechanisms, signal timers, fog horns, aircraft flasher units and other related apparatus designed for use in the marine and air transportation field.

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F-104

DIARIO OFICIAL's modern newspaper office and plant in Bogotá gets a call from Burroughs man Fernando Arias

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THE RAPID economic expansion in South America is well evidenced in Colombia. Its chemical industry has made great gains in international markets. Volume production is growing. Colombian businessmen are mechanizing their office systems to pace this volume. And they're getting the most advanced business machine advice available from Burroughs men such as Fernando Arias of Bogotá.

In 1949 Fernando Arias became a member of Burroughs' world-wide sales organization. In his first year, he received extensive training in Colombia. Later, he attended a course in advanced business methods at Burroughs' Detroit headquarters—the world clearing house for modern business developments.

The success of Fernando Arias' training is pointed up by the numerous important clients he has added to the ever-growing customer roster of Burroughs de Colombia.

Throughout the world, Burroughs men like Fernando Arias are called upon by management to provide the most advanced business methods and machines available. These highly trained specialists have the knowledge of the latest developments in business methods. And they know how to apply them to any business, anywhere.

Let a Burroughs man help you. For his address, write to Burroughs Corporation, Detroit 32, Mich., U.S.A.

Looking Ahead in Technology

● **FLAT TELEVISION TUBE nears practicality.** Dennis Gabor of Imperial College, London, has designed a flat shadow-mask color TV tube. It is shaped like a flat glass box that would be about 12 cm. deep for a 52-cm. screen. Electrons travel downward from guns (one for each color) and are deflected horizontally onto the screen by scanning plates. (*Electronics, Jan* 1, *p*14)

● **LONGER LIFE, greater efficiency, and smaller size for electrical equipment may result** from Westinghouse Electric Corp's (U.S.A.) work on coating copper wire with aluminum. A high-temperature insulator covers the aluminum. When oxygen seeps through, oxide forms on the aluminum and prevents penetration to the copper. In conventional wire, oxygen combines with copper and degrades the insulation. (*Chemical Week, Dec* 22, *p*38)

● **DETERGENTS FROM SUGAR moved a step closer to production and marketing** with the recent granting of process licenses in the U.S.A. and elsewhere by the Sugar Research Foundation (52 Wall St., New York 5, N. Y., U.S.A.), the patent holder. These detergents are reported to be nontoxic, nonirritating, odorless, tasteless, and only slightly soluble in water. (*Chemical Engineering, Jan, p*110)

● **SHEET STEEL is being cast in Russia by a method that eliminates all of the steps between the converter and the sheet rolling mill.** The Soviets say the process is a combination of continuous casting and rolling. Molten steel is poured into a graphite funnel that spreads the steel to the required width. Two water-cooled rollers grip the steel. The difference in temperature between the rollers and the steel crystallizes the steel.

Conventional hot rolling of steel sheets requires 9 times as much machinery, 12 times as much electricity, 8 times as much fuel, according to the Russians. Thickness of the finished cast sheet ranges between 0.05 cm. and 0.12 cm. (*Product Engineering, Jan, p*10)

● **A WORLD PUBLIC OPINION poll by McGraw-Hill aimed at finding out which nation has the reputation for atomic leadership.** Government atomic energy officials, industrialists involved in atomics, editors, and the public—or "man-in-the-street"—were polled. The questions and answers:

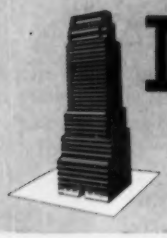
(1) What country do you consider to be the leader in development of civilian nuclear power? Results: All but one group voted the lead to the U.S.A., with Britain a close second and Russia a poor third. But the atomic industrialists believed that Britain was far ahead of the U.S.A.

(2) What country do you consider to be the world leader in development of all peaceful uses of atomic energy? Results: All groups gave a clear preference for the U.S.A. Just one group, the man-in-the-street, thought Russia should be in second place, ahead of Britain but behind the U.S.A. (*Nucleonics, Jan, pR*6)

● **THE AVOIRDUPOIS SYSTEM may soon be discarded in favor of metric measure** by U. S. drug manufacturers. Reasons: easier record-keeping, calculation of production runs, packaging and purchase requisitions. New vitamins, antibiotics, and other products are carrying metric weights, but older products are generally being labeled in avoirdupois units. (*Chemical Week, Jan* 26, *p*48)

● **POWDER-METAL BEARINGS with built-in graphite are now available.** Made in Germany, the bearings' best application is in high or low temperature work, or where oil contamination is a problem. (*Product Engineering, Jan, p*203)

● **AUTOMATION is an accomplished fact in the new Leyland Motors Ltd. (England) foundry.** Automotive cylinder blocks are molded automatically (above) and cast on a mechanized production line. First the pattern is placed in position in mold boxes, then sand is poured around the pattern and rammed. The mold is stripped clear of the pattern and cores are inserted. The completed mold next moves by conveyor to pouring stations. Poured castings go to a shake-out machine which removes the sand. The sand is later reclaimed. The casting goes to a dressing station while the mold boxes go back to the start of the line. (*McGraw-Hill World News*)



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1. NEW MONEY FOR BUSINESS: A Guide to Long-Term Corporate Financing—By George J. Leness, Gillette K. Martin, and Roger T. Gilmartin. *McGraw-Hill Consultant Reports on Current Business Problems.* October, 1956. 153 pages $15.75

A concise study of the problems to be faced by companies needing capital, nature of the sources of the capital, and functions of investment bankers who act as intermediaries between those who need and those who have capital. Explains major methods of raising capital for business, with primary emphasis on long-term financing through sales of securities.

2. INDUSTRIAL DEAFNESS—By Josepf Sataloff, M.D. January, 1957. 350 pages..... $8.75

A fundamental reference in industrial noise and deafness—for all concerned with industrial deafness, from otologists and safety engineers to union leaders and judges. Fundamental treatment of noise and hearing-measurements, to enable reader to perform tests in each. Covers physics of sound, anatomy of ear, measuring, keeping records, conservation-of-hearing programs, etc.

3. MANAGEMENT ACCOUNTING FOR PROFIT CONTROL—By I. Wayne Keller. January, 1957. 435 pages..... $7.75

How cost accounting can best be used to maximize profits within a company—a management, rather than a bookkeeping approach to cost accounting. Follows sequences of management accounting processes—emphasizes interrelation of effects of income, cost, and capital on the profit of an enterprise. Presents techniques for controlling these three determinants of satisfactory profits.

4. FORECASTING BUSINESS TRENDS — By Leonard S. Silk and M. Louise Curley. *McGraw-Hill Consultant Reports on Current Business Problems.* September, 1956. 157 pages $15.75

Aims at reducing the margin for error in business decisions by methods of forecasting based on systematic use of statistical facts and economic intelligence. Helps management appraise and profit from economic reports and analyses.

5. COMMON SENSE IN BUSINESS: A DIGEST OF MANAGEMENT PROCEDURES — By J. Seton Gray. December, 1956. 136 pages $4.25

A terse, common-sense treatment of the ten major problems that confront all business ventures—large or small—and how they must be coordinated and solved to achieve success. Covers areas from management and selling to research and engineering.

6. THE SELLING POWER OF PACKAGING—By Vernon L. Fladager. November, 1956. 144 pages $4.25

How packaging emerges as a top-rank profit factor in business—and what the business man should know about packaging to make fullest use of its dynamic possibilities. The field is surveyed—things affecting packaging—the revolutionary effects it can produce.

7. STANDARD HANDBOOK OF BUSINESS TAX TECHNIQUES—By J. K. Lasser. February, 1957. 576 pages $14.75

Gives the business man an understanding of the implications of income tax to help him make more profitable decisions in many of the problems he faces today. Deals with tax in relation to the form of a business. Shows how to choose the right course where tax alternatives can result in a larger or smaller tax.

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Ceramic tools, hailed as a revolution in metalworking, have had a chance to show what they can do. Now there are some answers to . . .

How Good are Ceramic Tools?

Ceramic tools were the most important development in world metalworking last year (MD, May '56). But the basic question about them still remains "How good are they?" For its December 3 issue, McGraw-Hill's *American Machinist* went looking for the answer. After talking to several American companies, the magazine's editors found that:

1. Ford Motor Co. has set up a high-volume production application of ceramic tools, and is studying other applications. Finish-machining standard transmission sliding gears with ceramic tools has resulted in a 26.5% reduction in cost per gear. The operation includes finish turning, grooving, and facing the part on an automatic lathe. Material is forged steel with a Brinell hardness of 170 to 207. The part measures about 10 centimeters in diameter.

Five cutting tools are used on the lathe; three are ceramic cemented-oxide and two are tungsten carbide. The carbide tools were necessary because of the particular requirements of the job. A ceramic bit could not be used to cut a narrow groove on the part because the bit could not be clamped adequately. Instead a carbide bit brazed to the tool shank was necessary. The other carbide bit was used because the tool dragged across the work face on the return stroke. With ceramics, dragging would shorten the tool life.

The ceramic tools are run at 310 surface meters per minute, with a feed rate of 0.04 centimeters per revolution and an 0.03-centimeter depth of cut. Cycle time with carbide was 0.25 minutes, is now 0.18 minutes. No coolant is used.

Ford reports these advantages accruing from its ceramic tool experiences: less machine downtime, better finish, more parts per tool, higher speeds.

2. Scully-Jones & Co. rough turns bearing sleeves for milling-machine arbors with ceramic bits on a regular production basis. Material is cold-drawn steel tubing. Here are some of the company's findings as it works with ceramics:

—Rigid, well-maintained machines are essential. Toolholders must provide rigid support for the ceramic bits.

—Cutting-edge geometry is important. Best results have been obtained with clamp holders similar to those used for throwaway carbide bits.

—Work must be properly supported because of high cutting pressures and high speeds.

—Skilled machine operators are essential. Ceramic bits can be damaged if not entered into the cut slowly to avoid shock loading. But fairly heavy cuts can be taken.

3. Warner & Swasey Co. operates a test program for ceramic tools that includes both laboratory and production work. Clamped-on tools appear to be necessary because of the present performance and brazing qualities of ceramic tools. Carbide shims should support the bit. Rigid clamping of the ceramic in the toolholder is essential.

Speeds range from 120 to 420 surface-meters per minute. On some materials, cutting speeds can go as high as 900 surface-meters per minute. The depth of cut ranges from a light finishing cut of 0.03 centimeters to as much as 0.76 centimeters.

4. International Harvester Co. has completed a series of tests comparing ceramic tools with carbide tools. Results showed that with ceramics: (1) speeds above 360 surface meters per minute caused considerable abrasive damage to the cutting edges, (2) speeds below 120 surface meters caused a rubbing rather than a cutting action. Ceramic tools tested showed a much longer tool life than representative carbide tools. Material on which the tests were run was hot-rolled steel with a Brinell hardness of 180 to 190.

5. Sundstrand Machine Tool Co. feels that ceramic tools probably have a good future in metalworking plants where parts must be turned at high speeds, and to close tolerances. But the company points out that much development work remains before the ceramics reach a status comparable to that of the carbide tools. Higher-powered and higher-speed machines will be necessary if the cost savings possible with ceramics are to be realized.

Sundstrand used a punch-card controlled lathe for testing the ceramics. Punch cards control the lathe cycle and permit taking roughing and finishing cuts alternately without changing the setup.

Tests showed that the ceramic bits can be used for cutting speeds considerably higher than can be achieved economically with conventional carbides. But the ceramics should not be used at the highest possible speeds if economic tool life is to be achieved.

6. Monarch Machine Tool Co. has run extensive tests. In general, and especially under light loads, a good wear pattern was obtained. Edge strength of ceramic tools is sufficient to carry the chip load, and wear becomes mainly a function of abrasion. Ceramic tools are usually unsuitable where the tool must cut through heavy scale or where intermittent cuts are required. Under these conditions, as well as with heavy loads where there is a tendency to vibrate, the tool edge breaks down rapidly.

As far as these six companies are concerned, ceramic tools are here to stay. They were unanimous in talking about the advantages; ceramic tools could out-perform other cutting materials in many applications. But most warned that much research and development work still had to be done. And several pointed out that metalworking management will have to think in terms of heavier, more expensive machines before it can fully benefit from ceramic tools. ●

Two of America's top market researchers use advanced methods to probe the behavior of the consumer. The methods differ, but both say that . . .

Opinions Are Out of Date

1. Motivations and "Probing Deep"

Motivational research provides manufacturers and advertisers with important clues as to why consumers select particular products, maintains Ernest Dichter, president of Motivational Research, Inc. It also provides a blueprint of the consumer's emotional needs—needs which must be satisfied if both the advertiser and consumer are to benefit. This is how Dichter explains motivational research:

Getting to the bottom of people's motivations is not a simple task. People usually disguise their deep-seated emotional needs behind all kinds of rationalizations.

Your neighbor who buys an expensive, high-powered new car may rationalize his purchase by saying that the old car was dangerous. Therefore he needed a new one for safety's sake. But under motivational questioning, it may be found that his real reason is the desire for status, the need to be as successful and important as his neighbor.

Motivational research is concerned with many other consumer motivations. There is the need for security, the need to be treated as an individual, the need for self-expression, and so on.

In revealing the consumer's true desires, motivational research helps the advertiser to put over his message more effectively. It also helps the consumer to get what he really wants, not what he may say he wants. In a recent study, we discovered that women were resisting the beautiful, ultra-modern stoves because they felt that these wonderful new gas ranges were their rivals and not their allies. We suggested the company emphasize that the stove is the woman's creative partner and automatic ally, which helps to make her a more creative cook, baker, and housewife.

In another case, we recommended that the tea industry change their entire advertising approach. For a long time, tea was sold in the U.S.A. as a protective beverage, useful for colds, nervous tension, etc. We discovered, however, that men had come to the conclusion that tea was drunk by sickly or effeminate people, while drinking coffee was the mark of strength and masculinity. Tea sales started moving up when the revamped advertising presented a "product personality" of a hearty, robust drink.

The techniques of motivational research are those of modern psychology. Most importantly, we extensively use "depth interviews," which are long, discursive chats lasting some three to five hours. Unlike conventional researchers, who ask direct questions, depth interviewers encourage respondents to express freely all their feelings and associations about a given subject, to ramble on about all their experiences in dealing with the matter. This provides a kind of x-ray insight into the real underlying factors.

We also, as a rule, use a questionnaire and various visual stimuli which induce the respondent to project his real emotions and feelings.

The necessity for modern advertising to be consumer-centered rather than gadget-, gimmick- or product-centered, is a basic rule laid down by motivational research. It is a rule based on the axiom that what is good for the consumer—for his psychological needs—is good for the manufacturer. (*Business, Jan, p75*) ●

2. Reactions and "Experimental Design"

The market researcher's job, says Alfred Politz of Alfred Politz Research, Inc., is to predict reactions. To predict reactions, one must study reactions. And reactions are not the same as opinions, attitudes, or motivations.

Thus, a well-designed market survey aims at an arrangement of interviewing conditions from which the researcher, in the end, can calculate how consumers will act, irrespective of the correctness or incorrectness of their responses to interview questions. In short, the researcher's truth is objective—of a higher order than "true" opinions, motives, attitudes, or preferences hidden in the consumer's mind.

Consumer surveys come up with quantitative findings if they are to help management make marketing decisions. The method must be rigorously scientific. It must be experimental—it must start with an hypothesis and then test its validity with controlled methods.

A well-designed questionnaire usually looks dull and unrevealing; seemingly, it misses the main points. The questions seldom contain any verbal reference to the problem itself. For instance, a questionnaire on automobiles contained this question: "What makes of cars do you see here in this neighborhood?" It is difficult to imagine how results of this question could be used. The question, however, is logically related to the objective: to measure the effec-

tiveness of car styling. It is based on the assumption that the number of "good-looking" cars will be overestimated.

This simple question actually served as the basis for comparing the leading makes of lower-priced cars. The result was expressed as a quantitative ratio. It was found that for every 100 cars of each make on the road, "A" had a visibility index of 50, "B" of 80, and "C" of 100. Obviously style changes were called for in automobile "A." It should be noted that the crucial question was aimed at simple reactions, not complex preferences or motives.

The experimental design of a survey is a procedure to obtain information about the relationship between people and goods, and hence the appropriate market moves, from observation and verbal responses, irrespective of the "truth" of the responses.

A productive technique—particularly in a complicated research problem—is to cross reference two or more questions.

Suppose, for instance, we want to find out what an automobile manufacturer can do in relation to consumer's ideas of "pickup," i.e., acceleration. The first task is to clarify the concept of acceleration. Acceleration involves a comparison of speed with a weaker estimate of time. Enormous errors may result if another agent enters the field. Is there such an agent? What effort does the motorist make? He presses down the accelerator pedal.

We can formalize this idea into an hypothesis: If the actual acceleration of two cars is equal, then the motorist tends to give credit for acceleration to the car with the softer spring on the acceleration pedal. Now we are ready to design an experiment to test this hypothesis.

In some part of the interview the respondent is asked whether his car has good pickup. In another part, the ease of handling the car is discussed—steering wheel, gear shift, brake, ease of pressing and holding down the accelerator pedal, etc. The answers to both of the key questions are rather vague and useless in themselves. There is no probing for deep seated opinions; the answers are reactions. A cross tabulation of the answers showed that pickup and ease of accelerator pedal action have a significant relationship. Engineering data offered no explanation.

The motorist has told us, without realizing it, that softness or stiffness of the accelerator spring is largely responsible for his opinion of his car's pickup.

Such productive relationships between questions do not occur accidentally; they must be designed. And common sense cannot be ignored.

For realistic conditions, the research design must provide enough time to uncover developing changes. A series of surveys is one way to do this.

When the first survey is finished, some of the assumptions are proved, others are not. A more efficient survey can then be designed. (*Harvard Business Review, Jan-Feb, p* 117) ●

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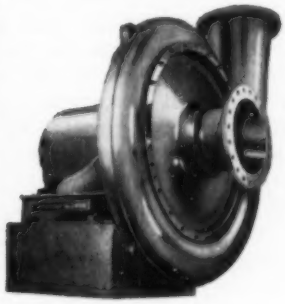

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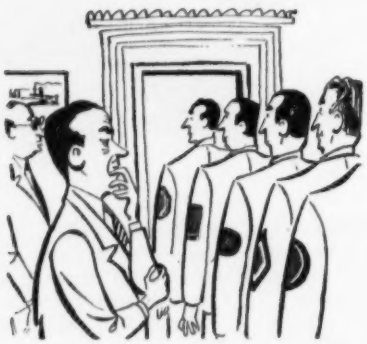
In Marketing

● **THE DESIGN CENTER in London, operated by the British Council of Industrial Design, was visited by 380,000 people** in the first six months of its existence—an average of almost 2,500 a day. Trade buyers from 46 countries signed the register—and over 11,000 inquiry cards were passed to manufacturers.

The Center aims at two ends: (1) to convince retailers that it is good policy to sell well-designed goods, and (2) to convince manufacturers that it is good business to make them. There are an average of 1,000 exhibits at any one time. Displays are continuous, but constantly changing. Three special shows have been mounted; and all goods on display are in current production. (*The Times Review of Industry, Dec, p14*)



● **EMBLEMS—used since the 17th century for identifying craftsmen—are finding wider use as a sales promotion aid.**

With the proper approach, personnel can be turned into walking billboards to tie in with an advertising campaign. A first requirement: The advertising theme must be symbolized with a brief slogan or symbol.

To develop an effective emblem, keep three points in mind:

1. Keep it simple. Visibility is greatest with a bold design and contrasting elements.

2. Use color with restraint, yet boldness. It is seldom necessary to go all-out on color.

3. Stick to regular shapes. Ovals, circles, rectangles, and squares are preferable to irregular shapes. (*Printer's Ink, Dec28, p72*)

▶ FINANCIAL DIGEST

"Bad times are here again, and it is time for investors to start thinking about buying." This paradoxical statement, made by *The Economist* and directed at the British investor, has meaning for investors and businessmen all over the world.

The most successful investors, *The Economist* points out, are those who buy in a depressed market and sell during a boom. Hard times for the industrialist often mean opportunity to the investor. The prospects for 1957 are for narrower profit margins and probably some reductions in profits and dividends. *The Economist* lists four dangers the investor should be wary of:

1. Another weakening of sterling—reversing the present upward trend. The investor who wants to hedge against sterling can look to dollar stocks and gold shares, with copper and diamond shares as "second strings."

2. Some loss of competitive power by British industry as the bills for the Suez affair are added to industrial costs.

3. Some recession in commodity prices after the Suez canal is cleared.

4. The risk, though it is not a certainty, of a market recession on Wall Street from which British shares would not be immune.

The Economist does not suggest that investors rush into the industrial shares market. There are many risks; and the shocks of 1957 have yet to be felt. But as events unfold, the wise investor may find profitable possibilities that are overlooked by the "fair weather" investor.

●

U.S. corporations will need $7,000-million in outside financing this year—continuing the rate of borrowing in 1956, a New York banker estimates. Outside financing is needed when the money available through depreciation, undistributed earnings, and other internal funds is not enough to cover capital requirements.

Financing problems of American businessmen, as well as businessmen everywhere, have increased as (1) credit has tightened, and (2) the proportion of antiquated equipment in place has increased—despite the high rate of investment since World War II.

Last year, for instance, roughly 45% of the total business investment in the U.S.A. was spent for replacements, not additions. And many economists believe that replacement and modernization expenses will make greater and greater demands on the world's investment capital.

●

Volkswagen, the phenomenally successful West German auto and truck producer, may finally become a publicly-owned stock company if present plans in Bonn go through. German investors never got a chance to buy stock in Volkswagen, started by Hitler and now under a "trusteeship" of the German government. The company is run by a council representing management, labor, and the government.

The Bonn Parliament has passed a first reading of the government's proposal. But political opposition and legal disputes will delay a stock issue for at least a year.

●

Montecatini, the Italian mining and chemical colossus (MD, Oct, p16), is trying to woo U.S. investors with special "American" shares that pay dividends in dollars.

Titanium: Still Booming, But a Long Road Ahead

Digested from BUSINESS WEEK, Jan 26, p180

For eight years, titanium's growth has been furious. This is the one certainty whenever people talk about the metal. After that a number of questions come up in their discussions.

Biggest question is whether titanium will be a mainstay metal like aluminum, or whether it will remain a high-priced luxury.

Meanwhile, titanium production continues to grow. Last year, world output neared 16-million kilograms. Back in 1948 production amounted to 1.5 kilograms. Most important producing countries for 1956 were U.S.A., Britain, and Japan.

Two characteristics, mainly within the aircraft industry, account for the boom in titanium. It is lightweight (40% less than stainless steel) and resistant to moderately high temperatures, with useful strength up to 540°C. (aluminum, on the other hand, begins to weaken above 150°C.).

Because of these advantages, titanium has been growing up in the age of jets, just as aluminum prospered with the increase in airplane building before World War II. But so far, this growth has been based mostly on titanium's potential and is limited to military equipment. It has no yet arrived as a workable industrial material; there are growing pains it still has to suffer. Right now these are some of the metal's drawbacks:

—Titanium is expensive.

—Molten titanium reacts vigorously with furnace materials; ordinary melting and casting methods will not work. So far, a commercial casting method has not been found.

—Scrap losses are high—about 50%.

—Fabrication is difficult.

But the outlook is by no means black. Titanium technology has improved too. The problem of alloy brittleness has largely been overcome; sheets are flatter; thickness tolerances are lower; sheets are freer from scratches. And prices have steadily come down. Latest U. S. price is $1.24 per kilogram and last year Imperial Chemical Industries Ltd. (Britain's chief producer) announced it would have $1.33-per-kilogram-titanium available. In 1955 titanium would cost you $2.25 a kilogram.

One expert puts development of titanium this way: "It is a crash program. It may be possible to accelerate scientific research, but fabricating — forming, forging, bending—is an art. You cannot hurry it."

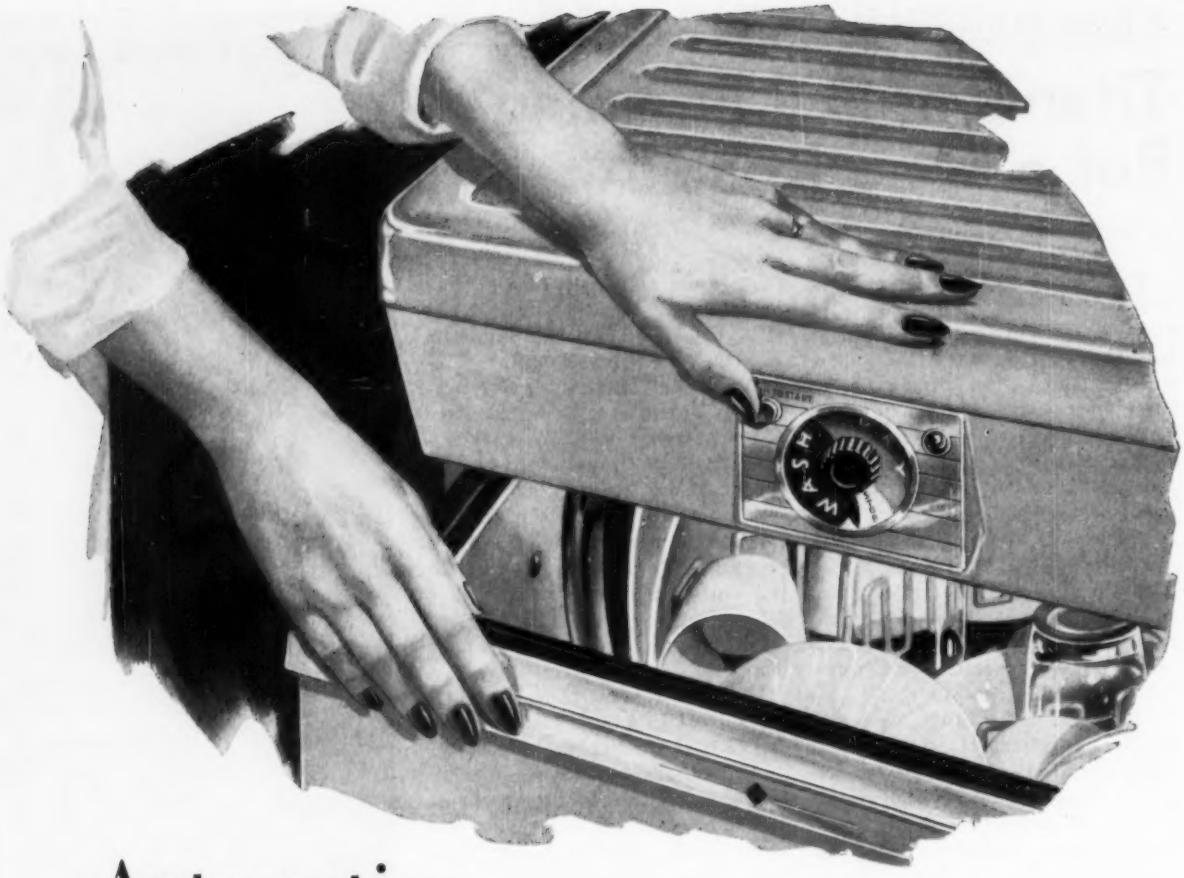
It is high price that keeps titanium out of a huge civilian market. But if the present price drop continues, there is a spectacular vista of applications in the chemical and processing industries. Titanium's big advantage here is its resistance to corrosion.

Titanium clips and racks have been highly successful in anodizing aluminum parts. They hold the aluminum in chemical baths, and have lasted 50 to 100 times longer than previous materials and amply justified the higher original cost.

Titanium has also pioneered uses for itself for valves and piping in the chemical industry, piping systems in nuclear reactors, food processing kettles, heat exchangers and vessel linings that come into contact with corrosive chemicals, and in the marine field. Most applications will be in heavy industry.

Most titanium producers, unhappy with their current complete dependence on the military, regard their real future as lying in the civilian market. They realize, however, the barrier of present prices. Meanwhile, defense orders offer a chance to attain volume production and cut costs for an eventual civilian boom. ●

SEMI-FINISHED titanium sheet goes through a heating furnace and is rolled in mill (right) to proper gage.



Automation...

Proved in the Home—Ready for Factory and Farm

In millions of appliances, Mallory Timer Switches automatically control complex work cycles . . . now offer low-cost automation for machines performing varied operations on preset time cycles.

With dishwashers, clothes dryers and home laundries taking on a large share of tiring chores, millions of housewives can testify that automation is a pleasant reality in the home today.

Dependable, automatic operation of these time-savers is made possible by a unique timer switch —a rugged, precision device developed by Mallory at a price that cost-conscious appliance manufacturers can afford.

Now this switch also works outside the home. For example, it masterminds the operation of an improved milking machine . . . acts as cook and cashier for new vending machines that provide varied hot and cold food in factories, schools, public places.

Readily adaptable to almost any series of operations, the Mallory timer switch offers the benefits of low-cost automation to a range of equipment from computers to temperature controls . . . from metal-working machines to plastic molding presses.

The dependable performance of this precision switch is typical of all Mallory products in electronics, electrochemistry and specialized metallurgy—the fields in which Mallory serves the Nation's growth industries.

P.R. MALLORY & CO. INC.

MALLORY

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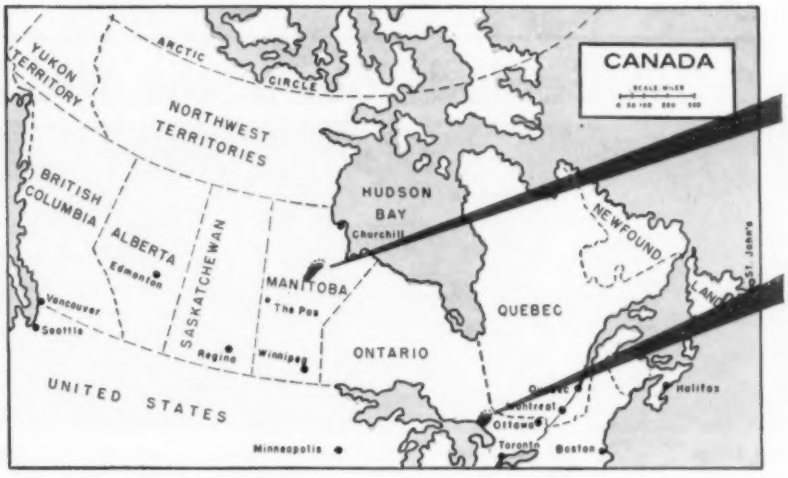
P. R. MALLORY & CO. Inc. INDIANAPOLIS 6, INDIANA



NEW MINES in this area will ease the critical world nickel shortage.

SUDBURY BASIN supplies nearly 80% of free world's supply of nickel.

Good News for Nickel Users

The province of Manitoba will soon add a new mining town called Thompson to Canada's map. By 1960, Thompson's miners will be turning out close to 58.5 million kilograms of nickel a year for International Nickel Company of Canada (the town is named after Inco's chairman), the market-setting giant of the world nickel industry. Inco's production will then total 173 million kilograms, which will go a long way toward meeting a predicted—and urgently needed—free-world supply of 281 million kilograms within five years. Total free-world production currently runs at 200-million kilograms a year.

The supply of nickel has been on the critical list since the Korean war. Nickel is an essential ingredient of the special-property metals that go into jet planes, gas turbines, and atomic-energy equipment. Last year the biggest gains in nickel use were in high-temperature and electrical resistant alloys, nonferrous alloys, and stainless steels, according to McGraw-Hill's *Engineering and Mining Journal.* More nickel was also used in electroplating, catalysts, ceramics, and magnets.

Users of the metal are happy about Inco's development plans for the Mystery-Moak Lakes area in Manitoba. But, paradoxically, they are equally happy about a 15% price increase—raising Inco's U. S. contract delivery from 64½¢ to 74¢ per pound. Inco's market position is so dominant that deliveries by smaller companies and dealers—in the U.S.A. and Europe—are commonly referred to as "gray-market" prices, which have climbed as high as $3 a pound in recent years.

The price increase was good news because smaller companies—even Canada's third largest producer—had found it impossible to expand in the face of Inco's low price for concentrate. "Inco's artificially low price," Sherritt Gordon Mines, president Eldon L. Brown told *Business Week,* "wasn't high enough to encourage new production. There wasn't enough profit in it for us."

Inco's price policy was at least partly based on a fear that a price increase would intensify the consumer's hunt for substitute metals. Steel makers have long been experimenting with various quantities of molybdenum and other metals in stainless steel. The U. S. Senate Small Business Committee recently charged that development work—and industrial growth—had indeed been hampered by the nickel situation. But the Senators blamed the low supply instead of the low price.

Concern over the scarcity of the jet-age metal has been greatest of all in the defense departments of Western nations, and especially in the U. S. government. A major market influence has been American purchases for the emergency stockpile. The turning point for nickel came last year when the U. S. government released some of its stockpiling contracts to industry. Released nickel totaled 35.5 million kilograms—25 million kilograms more than released in 1955. As a result, "spot" prices for close-delivery contracts dropped from the $3 level to around $2.15. Larger diversions are expected in 1957.

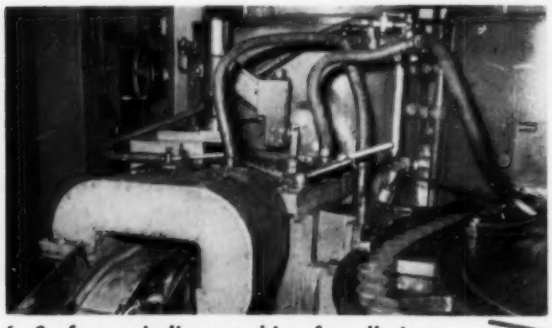
The U. S. Office of Defense Mobilization also announced a revised incentive plan aimed at providing America with an annual supply of 198 million kilograms by 1961. The ODM will pay premium prices to cover "unusual" development costs. Inco's Manitoba project will qualify under the provisions, reports say. Two U. S. companies are also said to be negotiating incentive prices to expand their nickel property in Cuba. Small Canadian producers are being encouraged to expand mining and smelting.

Current explorations in the Populus Lake area of Canada are being actively pushed. Ore deposits in the Dominican Republic look promising. And mines in New Caledonia supplying mostly French and Japanese smelters—are expanding.

Norway is raising its refining capacity to 25 million kilos per year. Also, U. S. government-owned plant in Cuba is increasing its output 75%.

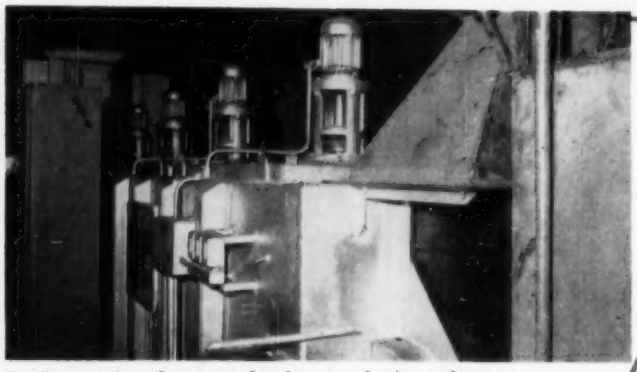
People in the industry, *Business Week* reports, think that ODM's incentives and Inco's "change of heart" may ease the nickel shortage by late 1958. Barring a defense emergency, supply and demand could be brought into balance in three years. But demand is increasing as well as the supply. ●

A Guided Tour of the World's

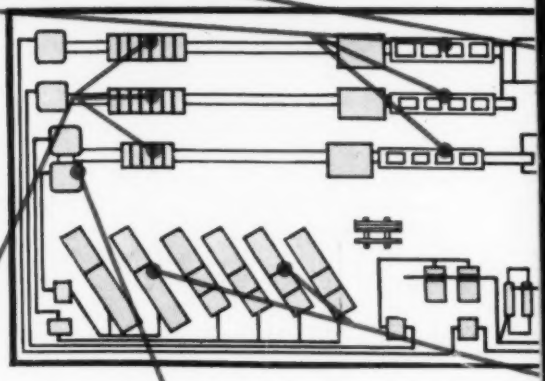


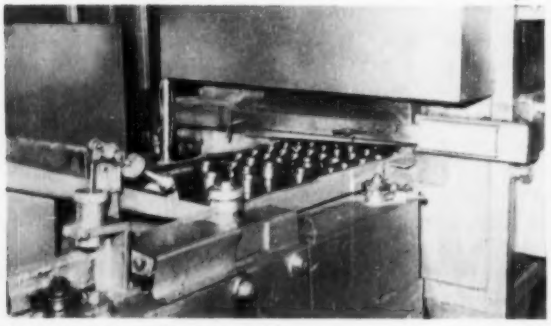
6. Surface grinding machine for all rings

7. Grinder line for taper rings

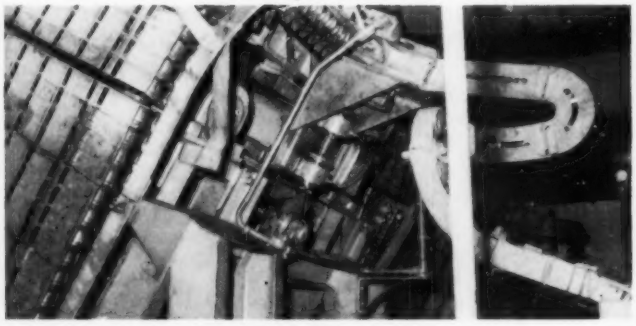


5. Tempering furnace; background, deep freeze





4. Entrance to heat-treating oven



3. Storage magazine, outlet side

In Moscow: A Production Line

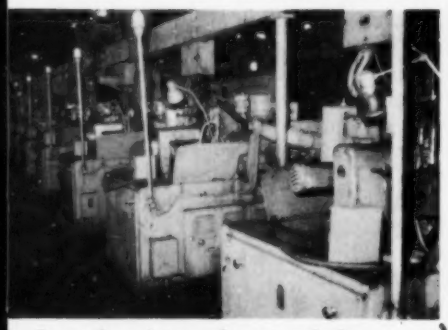
Digested from METALWORKING PRODUCTION, Jan 11, p47; AMERICAN MACHINIST, Jan 14, p147

From the time raw material and components go through the doorway (START—see above) of Moscow's automated ball bearing plant to the time the packaged product leaves (FINISH), not a human hand interferes. Output of the production line is 1.5-million bearings yearly—900,000 ball bearings and 600,000 tapered roller bearings. The bearings are made to international sizes for tractors, automobiles, and industrial applications.

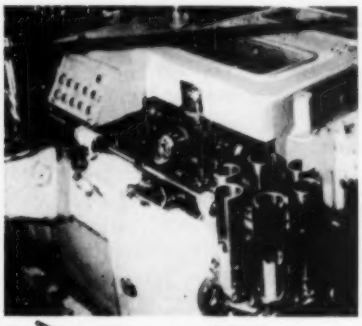
Only 89 men operate the plant. They include maintenance men, electricians, and presumably the director—but not one machine operator.

Western experts have called the Moscow plant the most advanced production unit of its kind in the world. And they are particularly impressed by the Russian's claim

'Most Automated" Bearing Plant

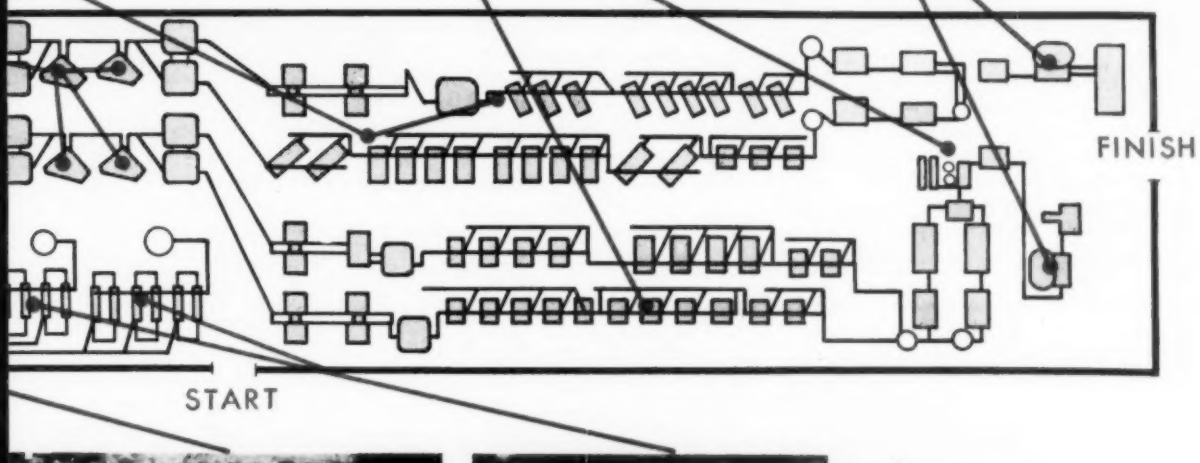


8. Centerless internal race grinders

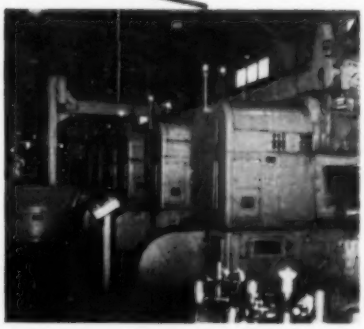


9. Automatic assembly

10. Automatic packaging



2. Bar-type automatic lathes



1. Automatic lathes, hoppers

Step-by-step, here is how the Russians make ball and roller bearings.

Without Operators

that the plant was only 6 months in design, and just 18 months more before it went into production. Apparently cost was no object — hundreds of designers worked round the clock planning the plant. And the planners drew machines from all over the Soviet Union instead of waiting months or years for machines to be built.

Two production lines, one for ball-bearing rings and the other for roller-bearing rings, run through four main sections—turning, heat-treating, grinding and assembly. Only rings are machined by the plant; balls, rollers and cages are made elsewhere and joined with the rings at the plant's automatic assembly machines.

Rough tube stock and rings come in through the plant doors. (START), are delivered to hoppers and storage preparatory to turning operations. From the hoppers, rings for roller bearings are conveyed to six lathes

(Step 1). Three turn inner rings, three turn outer rings. A special loading and transfer arm moves between the two heads on each lathe. It loads a blank into the first head and transfers it, after machining, to the second head, and finally to a conveyor.

Ball-bearing rings are machined from tube stock on automatic bar lathes (step 2). The method here is regarded as more-or-less conventional.

All bearing rings are marked after turning on automatic marking machines. After marking, rings go to the automatic heat-treating section. Because of differences in cycle times for turning and heat-treating, a buffer stock has to be held in special magazines (step 3) between the two sections.

Ovens (step 4) are electrically heated to 875°C. From the ovens rings go via conveyor to an oil-quench bath, washing machines, and an air-jet dryer. After drying, the rings get a deep-freeze treatment (step 5) at −13°C. to insure dimensional stability. Next the rings pass through a tempering furnace (step 5) at 150°C., completing the heat treatment.

Rings then move into storage magazines, are doled out as needed and conveyed to two automatic surface grinders (step 6). During the grinding operation, a gaging unit checks size and makes automatic compensation for wheel wear.

Four storage magazines feed four automatic grinding lines: one each for inner and outer taper rings (step 7) and one each for inner and outer ball rings. All outside diameters (OD), except for the inner taper rings, are ground on pairs of automatic centerless grinders. These do the job in two passes; seven were formerly required. The taper track on the OD of inner taper rings is produced on two other centerless grinders.

Eleven special machines grind the races of ball bearing outer rings (step 8), grinding and superfinishing internal surfaces, including the ball groove itself. All grinders are conveyor fed.

After grinding, the finished rings go to magazines, then are washed before assembly, which is done in a temperature-humidity controlled room.

Automatic inspection and gaging machines check each component as it goes through. Gaging is pneumatic-electric. Bearings outside tolerance are indicated by warning lights and shunted aside. Good units go on to assembly.

The automatic assembly machine for taper roller bearings has four stations: cages are first indexed, rollers are dropped into position and the inner ring assembled. Inspection is next.

The ball-bearing assembly unit (step 9) is an integration of four machines—one that grades the rings, one that delivers the balls, one that assembles, and one that controls radial spacing. All four units are tied electronically.

After assembly, ball and roller-bearings are given an anti-corrosion treatment. Chilled Freon gas congeals the anti-corrosion compounds before moisture can enter.

Final step: packing bearings automatically (step 10) in paraffin paper—boxes are automatically made up from cardboard, bearings go into the boxes, which are sealed, labeled and transferred to a table where they are wooden-crated for dispatch.

From start to finish not one human operator has reason to touch a part. When asked whether a line as completely integrated as this one does not offset its advantages by a loss of flexibility, Moscow engineers said that this had been allowed for in the design stage. Every machine tool in the line can accommodate work 15% larger or smaller than that for which it was designed.

Is a fully automatic line worth the trouble? The Russians answer "Yes". Moscow's bearing line is regarded as just a beginning, not the ultimate. The experience gained there will be followed in building new lines that can produce other types of bearings. And when the right time comes, the machines in the Moscow line could be transferred to other, not yet fully-mechanized, plants. In fact, this year-old plant is already considered by the Russians to be obsolete. ●

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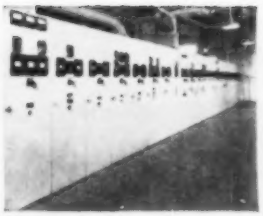
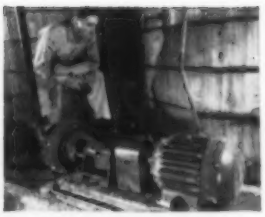
GRINDING MILLS: Allis-Chalmers has built grinding mills for over a half century—more grinding mills than any other manufacturer!



SWITCHGEAR: Allis-Chalmers low voltage all-metal switchgear is known everywhere in the world for safety, convenience and long life.



MOTORS: A world leading electric motor manufacturer for over 50 years, Allis-Chalmers furnishes motors in a wide range of types and sizes for applications in every industry.

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Allis-Chalmers serves the ORE PROCESSING INDUSTRY
. . . and all the major industries of the world!

SINGLE PIECES of ore weighing as much as four tons and heavy sticky material adhering to the screen body present severe operating conditions. But this heavy-duty Allis-Chalmers screen continues to meet large volume requirements because it was designed for mining's toughest scalping jobs.

This is an example of how Allis-Chalmers combines engineering and manufacturing ability to meet successfully the equipment needs of the ore processing industry. In the same way, Allis-Chalmers serves all other basic industries of the world.

You can apply Allis-Chalmers skill and engineering teamwork to your machinery problems—big or little. And, through license agreements with leading firms throughout the world, certain types of Allis-Chalmers equipment can now be manufactured abroad for purchase in leading world currencies. For further information, contact your local Allis-Chalmers distributor or write Allis-Chalmers, Industries Group, Export Department, Milwaukee 1, Wisconsin, U.S.A., for all the help you need.

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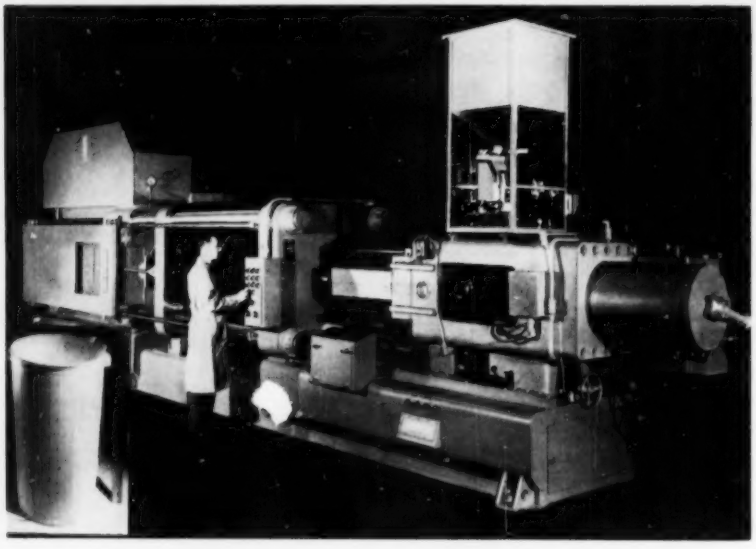
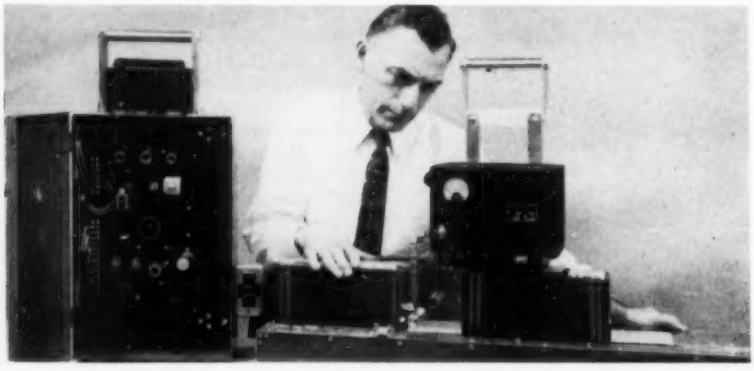


Plastics Injection Molding Machine

This new 48/64 ounce plastics injection molding machine was built especially for molders who need a machine for molding extremely deep parts (such as the 20¼ inch polyethylene waste basket in inset). It will also handle average molding jobs. The machine features a 54-inch mold clamp stroke and 84-inch daylight; a high injection speed of 2,410 cubic inches of material per minute; and a mold area of 36 by 54 inches. **(The Hydraulic Press Manufacturing Co., Div. of Koehring Co., Mount Gilead, Ohio, U.S.A.)**



Electronic Unit Checks Packages

Any package containing a material that affects the flow of high-frequency current may be efficiently checked on the production line with this electronic inspector. Typical applications include checking for proper weight and product level, for presence of a cap, or for inclusion of a premium item.

Operation of the "Package Inspector" depends on high-frequency current passing through the entire package. All materials respond to this current in proportion to their electrical properties, and to the volume of materials present. Since some items conduct more efficiently than others, it is sometimes possible to single out certain materials inside a package to determine if they are present in the proper quantity. **(Photo-Bell Sales Corp., 43 Vesey St., New York, New York)**

Glass-Walled Autoclave

Built of glassed carbon steel, a new autoclave will handle reactions where internal pressures go as high as 750 pounds per square inch. The glassed steel construction prevents any undesired catalysis in the product.

The two-blade impeller agitators are also made of glassed steel, and a wide selection of agitation can be obtained from the variable-speed drive. Provision has been made for a thermometer well. Capacities are one, two, or three gallons. **(The Pfaudler Co., 1023 West Ave., Rochester, New York)**

New Caulking Strip

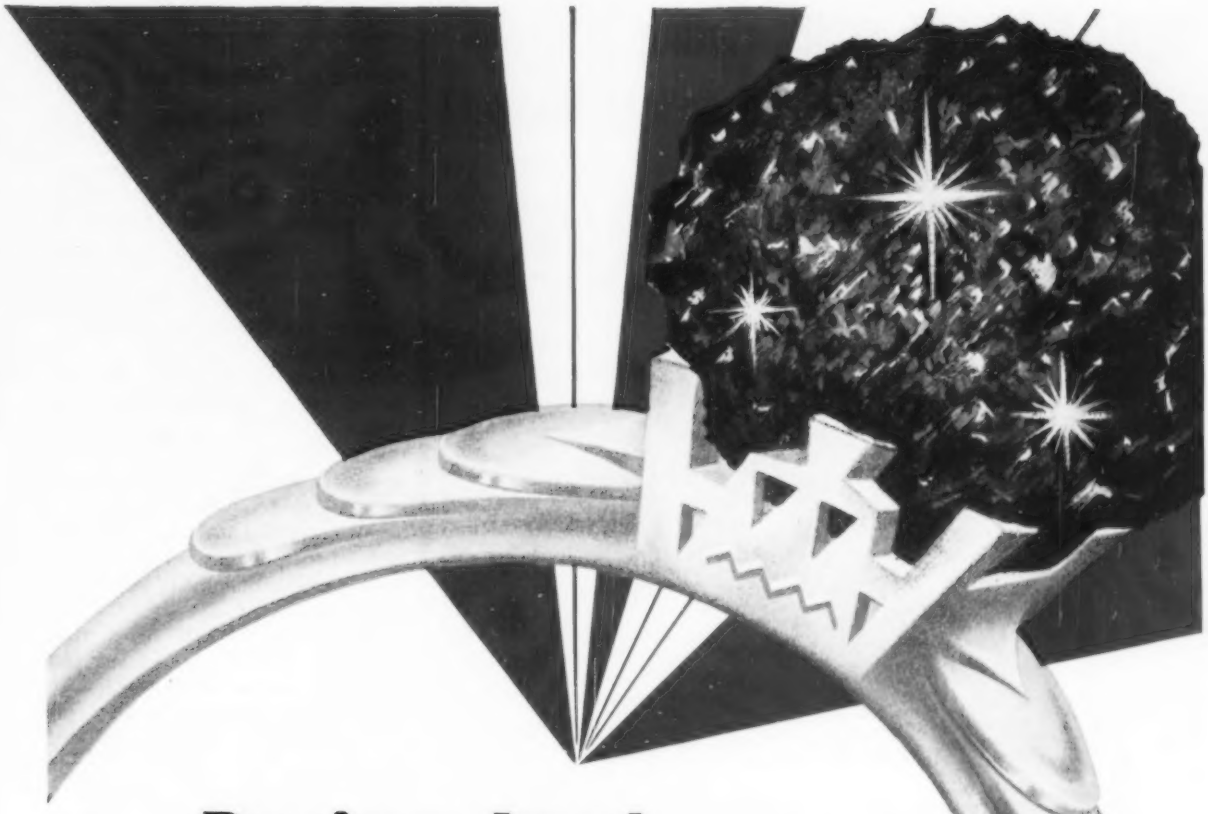
Perfect seals of concrete pipes or earthenware pipes, expansion joints, etc., can be obtained with a new caulking strip. The strip has such elasticity that if the dimensions are 2×2 inches, for instance, and the thickness is compressed from 2 inches to ¼ inch between two concrete surfaces, months or even years later this strip will always revert to a 2 inch thickness.

The strip is supplied in all desired sizes and lengths. It is acid-proof, alkali-proof, rot-proof, and heat-resistant up to 300° F. **(Comprifalt C.V., Posthoornstraat 6, Rotterdam, The Netherlands)**

Wet Belt Grinder

A new 9-inch wet belt grinder has been designed to derive more efficiency from the latest electro-coated resin-bonded abrasive belts. A feature of the design is that the abrasive belt pulleys, both driving and idler, are not "overhung" but supported on both sides in large ball and roller bearings, housed and protected by labyrinth seals.

The hardened and ground platen is mounted on a platen carrier. The carrier has a screw adjustment so that the platen can easily be squared to the work table. The unit is simple to operate. **(Taylor Tools & Supplies, Ltd., of Vortex Works, Broadheath, Altrincham, England)**



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MORE PRODUCT DIGEST

Plastic Axial-Flow Fans

Axial-flow fans made of rigid vinyl have been designed for the direct extraction of corrosive fumes. The fan is fitted within a duct system, and fan efficiency of 80% is reported by the unit's manufacturer.

The fan case is of welded Duoply vinyl laminate construction, flanged at the ends for incorporation in the duct. The impeller is of all rigid-vinyl construction, built around a cast aluminum core. The motor is specially coated with vinyl-based enamel and baked. The stator windings are double impregnated and re-coated to give the maximum possible durability under difficult conditions.

The motor is held by a ring bolted to the exterior of the fan case, and supported in position by three steel elongated tubes encased in rigid vinyl. The tubes not only hold the motor and impeller in position, but also act as breather ducts for the motor. **(Horwitch Smith & Co., Ltd., Pensnett, Brierley Hill, Staffs., England)**

Vertical Gearmotors

These vertical gearmotors are used for cooling tower fan drives. They were designed to replace present systems that use a separate right-angle speed reducer driven by a horizontal motor through a floating, flexibly coupled shaft. They are available in horsepower ratings from 15 to 75. **(Westinghouse Electric International Co., 40 Wall St., New York 5, New York)**

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BUILT, BACKED AND SERVICED BY Remington Rand

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DIVISION OF SPERRY RAND
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ADDRESS_____

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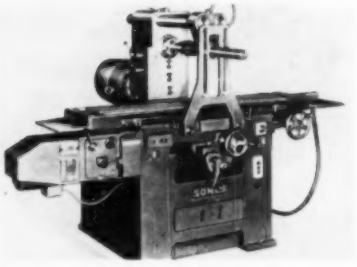
MORE PRODUCT DIGEST

Machine Sorts Nuts

Shelled groundnuts, or nuts and beans of similar shape, can be graded into sizes at a rate of about 500 pounds an hour with a new machine designed for use by the food industry.

The machine is made up of four units—one which grades according to diameter, and three which grade according to length. The nuts and beans are fed from a hopper into the diameter grader and are sorted by special vibrators into three main sizes—large, medium, and small. Split nuts are prevented from mixing with the others. They are then fed automatically through a hopper to the length graders which sort each of the three grades into long or short sizes. **(R. W. Gunson Ltd., 20 the Highway, London E. 1, England)**



Unique Milling Machine

The Somua Series Z milling machine features a cross-travel arrangement that differs from traditional bed-type design. The table carrying the workpiece rests directly on the bed, offering greater stability than conventional knee-type units. The knee, no longer fixed to the column by its lateral face alone, slides horizontally in the bed, which supports it along its entire length, whatever its position during cross motion.

The machine is made in two models, Z-1 and Z-3, and can accomodate vertical and universal heads, universal dividers, and circular tables. Model Z-3 (illustrated in horizontal setup) is said to be the first milling machine made to execute rectangular automatic cycles. **(Societe Soviem, c/o A.F.M.O., 64 Rue La Boetie, Paris 8, France)**

Fork-Clamp Attachment

This one truck does double-duty where two would otherwise be needed for dissimilar jobs. Used as a clamp, the fork attachment can pick up, lift, and carry bales 27 to 75 inches wide. With the upper set of clamping arms out of the way, it can handle pallet loads 75 inches high.

The attachment handles loads up to 3200 pounds at its 24-inch center. The fork carriage rotates 360°. **(Yale & Towne Manufacturing Co., 11000 Roosevelt Blvd., Philadelphia, Pennsylvania, U.S.A.)**

Teflon Tubing Now Available in New Sizes

Teflon tubing is now available in American Wire Gauge sizes of 0 (0.336 inches inside diameter), 1, 2, 3, 4, 5, 6, 7 and 28 and 30 (0.013 inches inside diameter). Known commercially as Teflon spaghetti tubing, it has been currently available in American Wire Gauge sizes through 26.

The high temperature spaghetti tubing is used as a low- and high-frequency insulation sleeving for electronic component development. The thin-wall tubing has a minimum dielectric strength of 750 volts/mil, a low dielectric constant of 2.0 and a high surface resistivity above 10^{12} ohms percm². It is said to completely resist soldering heats and is unaffected by bending and flexing during assembly.

The new sizes are designed to meet the requirements of a broadening range of applications. All sizes are available in ten coded colors for circuit identification. **(Polypenco, Inc., 2150 Fairmont Ave., Reading, Pennsylvania, U. S. A.)**

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Expanding midwestern mechanical goods manufacturer with annual sales over $200,000,000 is creating a new and important international division and is seeking a top executive experienced in international operations. Reporting to the executive vice president, he will be responsible and have full authority for establishing and administering a broad program including export sales, licensing agreements, and development of overseas manufacturing facilities. Age 40 to 55. Salary $25,000 up, depending upon successful candidate's qualifications, plus broad program of "fringe" benefits. Reply briefly on age, experience and personal background. All answers will be treated in complete confidence and will be acknowledged. P-4191, Management Digest, 520 N. Michigan Ave., Chicago 11, Ill.

If you cannot take advantage of this opportunity, please refer it to one who is qualified.

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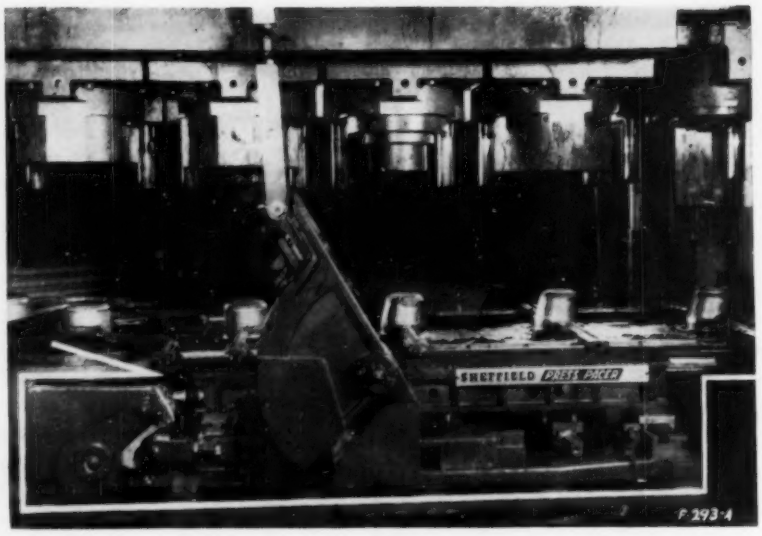
Model 160 Vari-Typer (electric typewriter with changeable type) features the Linomatic "leading" device which automatically inserts spaces between lines in professional printer's measure—from 0 to 18 points. By the use of a simple dial selector calibrated in half-point graduations, exacting typographic requirements are easily obtained. A reverse action mechanism also permits the feedback of paper to any desired position with unerring accuracy.

A signal light aids the operator when preparing copy for "justified" or even right hand margins. The light flashes on as the carriage nears the end of each line to indicate that the Vari-Typer is in the process of calculating spaces to obtain even right hand margins. A bell also rings when the copy limit for that line is about to be reached. **(Vari-Typer Corp., 720 Frelinghuysen Ave., Newark 12, New Jersey, U. S. A.)**



Unit Automates Any Standard Press

This portable mechanical transfer unit converts any standard press into an automated press capable of handling a number of progressive operations in a broader range of sizes. The "Press Pacer" transfers stampings from one die station to the next on each stroke of the ram. It can also transfer parts between presses.

The unit is adjustable for different spacings between dies and also for different ram strokes. It can be installed to run either front to back or left to right. **(The Sheffield Corp., Dayton 1, Ohio, U.S.A.)**

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A new electric watch operates on chemical energy stored in a tiny battery-motor. The 1½-volt battery releases energy through a coil of fine wire fixed on a balance wheel. There are two magnets on either side of the balance wheel and the interaction of the battery energy with the magnetic field causes the balance wheel to oscillate and to control the movement of the hands within 99.995% of accuracy. The battery for the electric wrist watch is guaranteed to operate for one year. **(Hamilton Watch Co., Lancaster, Pennsylvania, U.S.A.)**

Precision Rivetter

A new machine has been developed for use in industries that manufacture cameras, clocks, electrical apparatus, jewelry—anywhere that precision rivetting is required. Fragile rivetting is the machine's specialty, and it has reduced the difficulties in small cold rivetting operations, where the materials of either the rivets or the workpieces have varying physical properties. The unit is equipped with a device to vary its force to accommodate a wide range of rivetting conditions.

The manufacturer claims a remarkably high production rate for even semi-skilled operators, as well as low power consumption. **(Koki Shokai, Ltd., 20, 2-Chome, Honkamata, Ota-ku, Tokyo, Japan)**

CLARK EQUIPMENT moves mountains . . .

. . . of open hearth slag

Removing red-hot slag in front of the open hearth furnaces is only one of many vital jobs for this Michigan Tractor Shovel in a Canadian steel plant. With a special bucket built to fit the furnace doors, the all-wheel-drive Michigan loads material directly into the furnaces—also pushes charging cars into position, loads hoppers and cleans up refuse.

. . . or cases of "Coke"

To give their customers faster service in a Texas community, the local bottling company employs a Clark truck to load and unload cases of "Coke." It takes only fifteen minutes to remove the "empties" from a route truck and put a full load of "fulls" aboard. By high-tiering cases inside the warehouse, the Clark machine has increased storage capacity 50 percent.

Coke is the registered trade-mark of The Coca-Cola Company

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▶ YOUR MANAGEMENT READING

Management Digest's editorial staff here again does the "worthwhile reading" for you to save your time. For the following literature, please write on your company letterhead directly to the address given, mentioning Management Digest.

New Chemicals for Industry—*Chemical Week's* report contains formulas, chemical properties, suggested uses, and availability of 425 chemical specialties—from Acetoacet-o-Anisidide to Zircotan S—that were introduced in 1956. Price: $1.00. (Management Digest, McGraw-Hill Intl. Corp., 330 West 42nd Street, New York 36, New York.)

Selecting Your Staff—Research Report No. 27 suggests methods of increasing office production and reducing employee turnover by more effective selection of office workers. Price: $4.75. (American Management Association, 1515 Broadway, New York 36, New York) . . . "Interviewing for the Selection of Staff" brings together almost everything you may want to know about personnel interviewing. Price: 10s. 6d, or $1.47. (Allen & Unwin Ltd., Ruskin House, Museum Street, London, England.)

Sharing the Profits—The results of a survey of 200 profit-sharing companies are discussed in "Succeeding With Profit Sharing." Tells how to get the profit-sharing idea across, and shows the close relationship between the successful employee communications and a successful profit-sharing plan. Price: $4.00. (Profit Sharing Research Foundation, 1718 Sherman, Evanston, Illinois.)

Americans & the Tariff—"What the Tariff Means to American Industries" is a revealing study of eight U. S. industries, and why they behave the way they do about tariff matters. The book includes a detailed case study of the U. S. watch industry, and its protection demands. Price $5.00. (Harper Bros., 49 E. 33rd St., New York, N. Y.)

Meet the Nomogram—"Nomographisches Rechnen" is an introduction to nomography that requires a minimum of previous training in mathematics. It shows the advantages of using nomograms, the way various types are used, and methods of constructing specific nomograms. Price: DM 9.80. (Verlag W. Girardet, Gerswidastr. 2, Essen, Germany.)

Trading With Britain—The F. B. I. Register—a comprehensive and accurate guide to British Industry—lists products and services, company addresses, trade associations, brand and trade names, and French, German and Spanish glossaries. Price: 42s., or $5.88. (Iliffe & Sons Ltd., Dorset House, Stamford Street, London S.E. 1, England.)

Bulletins from Industry—Two new folders show how the "Series YC" Electric Arch can speed logging operations. (R. G. LeTourneau Inc., 2399 South MacArthur, Longview, Texas) . . . A 76-page handbook provides detailed information on all types and sizes of Yoder slitters and allied equipment. (Yoder Company, 5500 Walworth Avenue, Cleveland 2, Ohio . . . A materials handling catalog contains information on hand hoists, Pul-Lifts and trolleys, and tells how to select the proper type of hoisting equipment. (Yale & Towne Mfg. Co., Roosevelt Blvd., Philadelphia 15, Pennsylvania) . . . "Stokes Microwave Pumps for High Vacuum" contains a wealth of information that will prove helpful in meeting vacuum processing problems. (F. J. Stokes Corp., 5500 Tabor Rd., Philadelphia 20, Pennsylvania) . . . Haveg's materials and products catalog—C-14—covers corrosion-resistant plastic equipment, and a wide range of synthetic resin formulations. (Haveg Industries, 900 Greenbank Road, Wilmington 8, Delaware.)

Publications Digested

American Automobile
American Letter
American Machinist
Aviation Week
Business Education World
Business Week
Chemical Engineering
Chemical Week
Coal Age
Construction Methods & Equipment
Control Engineering
El Automovil Americano
Electrical Construction & Maintenance
Electrical Merchandising
Electrical West
Electrical Wholesaling
Electrical World
Electronics
Engineering & Mining Journal
E&MJ Metal & Mineral Markets
Engineering News-Record
Factory Management & Maintenance
Fleet Owner
Food Engineering
Industrial Distribution
Ingenieria Internacional Construccion
Ingenieria Internacional Industria
Metalworking Production (London)
National Petroleum News
Nucleonics
Petroleum Processing
Petroleum Week
Power
Product Engineering
Textile World
Today's Secretary

McGraw-Hill Publishing Co., Inc., 330 W. 42nd St., New York 36, N. Y.

The Management Review, Personnel, Supervisory Management
American Management Association, 1515 Broadway, New York 36, N. Y.

Metal Progress
American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio

Modern Packaging, Modern Plastics
Breskin Publications, 575 Madison Ave., New York 22, N. Y.

The Oil and Gas Journal
Petroleum Publishing Co., 211 S. Cheyenne Ave., Tulsa 1, Okla.

The Paper Industry
Fritz Publications, Inc., 431 S. Dearborn St., Chicago 5, Ill.

Petroleum Press Service
Petroleum Press Service, 91 & 93 Bishopsgate, London

Plastics, The British Motor Ship
Temple Press Ltd., Bowling Green Lane, London

Printers' Ink
Printers' Ink Publishing Co., Inc., 205 E. 42nd St., New York 17, N. Y.

The Rubber and Plastics Age
Rubber and Technical Press, Ltd., 147 Grosvenor Rd., Westminster, London

Sales Management
Bill Brothers Publishing Corp., 386 Fourth Ave., New York 16, N. Y.

The Times Review of Industry
The Times Publishing Co., Ltd., Printing House Square, London

Welding Engineer
Welding Engineer Publications, Inc., 12 East Grand Ave., Chicago 11, Ill.

American Builder, Marine Engineering, Railway Age, Railway Track and Structures, Railway Locomotive and Cars, Railway Signaling & Communications
Simmons-Boardman Publishing Corp., 30 Church St., New York 17, N. Y.

American Business
Dartnell Publications, Inc., 4660 Ravenswood Ave., Chicago 40, Ill.

Architectural Record
F. W. Dodge Corp., 191 W. 40th St., New York 18, N. Y.

Banking
American Bankers Association, 12 E. 36th St., New York 16, N. Y.

Business
Business Publications Ltd., Mercury House, 109-119 Waterloo Road, London

Ceramic Industry
Industrial Publications, Inc., 5 South Wabash Ave., Chicago 3, Ill.

The Controller
Controllers Institute of America, Inc., Two Park Ave., New York 16, N. Y.

The Economist
The Economist Newspaper, Ltd., 22 Ryder St., London

Harvard Business Review
Harvard University, Soldiers Field, Boston 63, Mass.

Heating, Piping & Air Conditioning
Keeney Publishing Co., 6 N. Michigan Ave., Chicago 2, Ill.

Industrial Marketing
Advertising Publications, Inc., 200 E. Illinois St., Chicago 11, Ill.

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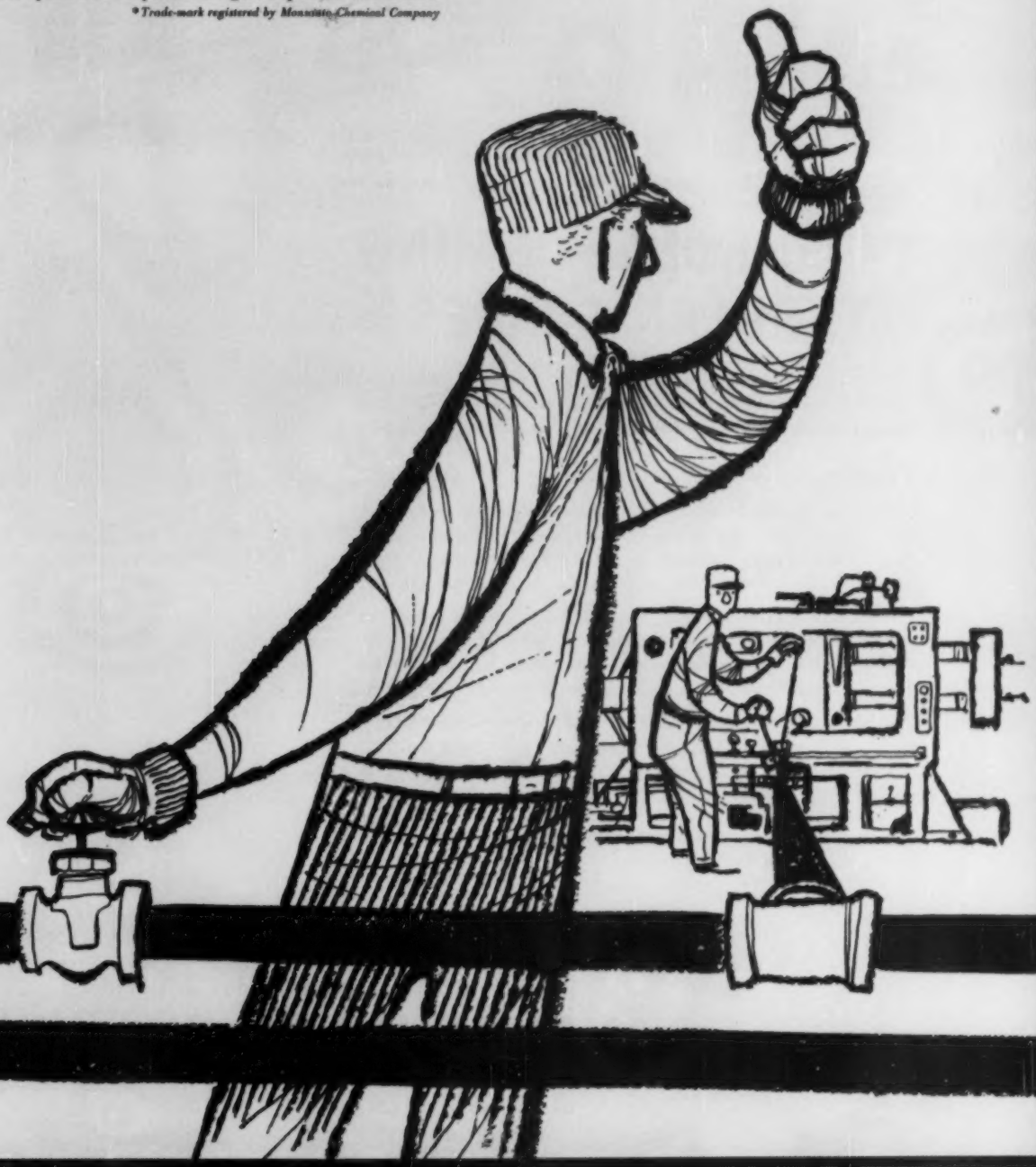

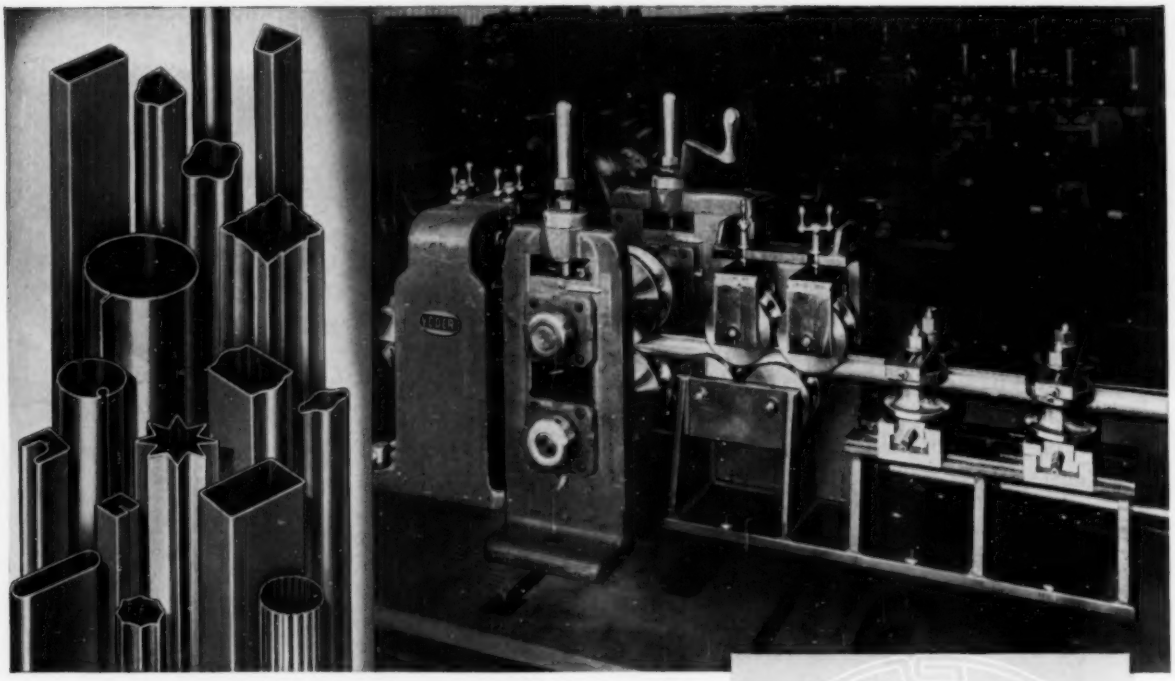

Lock-Seaming attachment at exit end of forming machine.

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